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NUCLEAR WASTE PROGRAM

HEARINGS

BEFORE THE

COMMITTEE ON
ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE

ONE HUNDREDTH CONGRESS

FIRST SESSION

ON THE

CURRENT STATUS OF THE DEPARTMENT OF ENERGY'S CIVILIAN NUCLEAR WASTE ACTIVITIES

APRIL 28 AND 29, 1987

PART 2

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NUCLEAR WASTE PROGRAM

TUESDAY, APRIL 28, 1987

U.S. SENATE,
COMMITTEE ON ENERGY AND NATURAL RESOURCES,
Washington, DC.

The committee met, pursuant to notice, at 9:32 a.m., in room SD-366, Dirksen Senate Office Building, Hon. J. Bennett Johnston, chairman, presiding.

OPENING STATEMENT OF HON. J. BENNETT JOHNSTON, A U.S. SENATOR FROM THE STATE OF LOUISIANA

The CHAIRMAN. Good morning. Today the full committee is continuing its oversight of the Department of Energy's Civilian Nuclear Waste Program.

At this hearing we will hear from technical experts, including the Nuclear Regulatory Commission and the National Academy of Sciences, on the health and safety issues involved in DOE's repository program.

The purpose of this hearing is to examine technical issues bearing on the question of whether the Department has done sufficiently adequate preparation for site characterization at the three candidate repository sites.

If there is more work to be done before characterization of the candidate sites in Washington, Nevada and Texas, we need to know that.

If any of these candidate sites should be disqualified now, we need to know that.

The Nuclear Waste Policy Act of 1982 is not a perfect law, but it is a good one. It was reached after many years of hard work, and it set up a rational process for development of a geologic repository. I do not believe we should give up on the fundamental principles laid out in the 1982 Act.

Unfortunately, the consensus behind the program was very seriously damaged by the Administration when the Secretary of Energy abruptly stopped the search for a second repository last May.

As a result of that action, the states selected for a potential first repository in the West have demanded a shutdown of that part of the program as well.

But the Department of Energy has collected a substantial amount of data on the three first repository sites selected for characterization. We need to determine if this technical work is sufficiently adequate to allow the process to go forward.

Today's witnesses will address the technical risks associated with nuclear waste management; the adequacy of the technical program thus far; and mechanisms for assuring technical adequacy throughout the program.

Today we will hear from Dr. Alvin Weinberg, a recognized expert in nuclear waste management; the Nuclear Regulatory Commission; the National Academy of Science's board on radioactive waste management; and the Department of Energy.

The NRC staff and the NAS board have each reviewed aspects of the Department's technical program, and will continue to play a major role in reviewing the technical work done by the Department during site characterization.

The Committee's hearings on the waste program will continue tomorrow. In the morning we will hear from witnesses concerning S. 839, the incentives legislation that I introduced with my colleague from Idaho, Senator McClure.

In the afternoon we will hear from witnesses concerning the Department's monitored retrievable storage proposal.

I might add, as a point of departure, that we have been hearing for weeks, months, I guess years, that the DOE's program was terribly deficient, that they've done all these things wrong, that we need to stop the program for a couple of years, have some expert group study it, and start all over again.

This morning we've gotten the best experts that we know in existence: Dr. Weinberg, and the NRC and the National Academy of Sciences are the best the country has to offer in this area.

I hope they will clear up this factual question, so that we will know which direction as a committee to go in.

So we will begin this morning with Dr. Alvin Weinberg. Dr. Weinberg, we appreciate your coming, sir.

STATEMENT OF DR. ALVIN M. WEINBERG, INSTITUTE FOR ENERGY ANALYSIS, OAK RIDGE, TN

Dr. **Weinberg**. Great pleasure to be here, Senator Johnston.

My name is Alvin Weinberg. I have been associated with the nuclear energy enterprise since its beginning, even before the first chain reaction was established in 1942.

I was Director of the Oak Ridge National Laboratory from 1955 to 1974, then was the Director of the Office of Energy Research and Development in the Federal Energy Office which later became the Federal Energy Administration in 1974.

From 1975 to 1985 I directed the Institute for Energy Analysis, and I'm now a distinguished fellow of that Institute.

I've been involved in the problem of waste disposal, mainly as a laboratory administrater, since the early 1950s; that's almost 35 years.

However, I don't regard myself as a specialist in waste disposal. My technical knowledge of the field derives from long association with people at the Oak Ridge National Laboratory and elsewhere, who were responsible for laboratory programs in waste disposal.

As early as 1952, Professor James Conant, who is President of Harvard and was President Roosevelt's wartime adviser on atomic energy, predicted that the world would turn away from nuclear energy because the problem of waste disposal would prove to be intractable.

A good part of my energy as Director of the Oak Ridge National Laboratory was directed toward proving that Professor Conant was wrong.

And indeed, if one were to judge by the estimates of most technical people, radioactive waste disposal is almost without exception not regarded as being a particularly difficult problem, technically.

It does not, for example, compare in difficulty with the problem of reactor safety. In the latter case, nuclear experts had realized from the outset that a reactor, generating enormous amounts of heat which cannot really be turned off, could be a serious hazard.

In case of the wastes, the heat generated is far smaller. There is no powerful driving force which, if uncontained, would cause massive spread of radioactivity.

Why, then, has the radioactive waste issue evoked such bitter opposition on the part of the public? Indeed, until Three Mile Island and Chernobyl, it evoked much greater public concern than had the issue of reactor accident.

I believe one important reason is the widespread misunderstanding as to the hazards of low levels of radiation. There is essentially no credible scenario connected with the entire waste disposal cycle, temporary storage, above ground transport, final disposal in a geologic depository, which imposes on any individual a really large dose of radiation.

This contrasts sharply with reactor accidents. At Chernobyl, for example, many people received lethal doses of radiation.

I believe the public, in expressing its fears of nuclear wastes, tends to confound possible releases from a waste repository with the far more lethal releases from an uncontained reactor accident.

Until and unless the public understands that doses of the order of background are inconsequential, waste disposal, even nuclear energy itself, will founder.

I therefore applaud attempts to educate the public as to the insignificance of radiation exposure at the level estimated to come from a repository.

In all fairness, though, there have been a very few improbable scenarios involving flooding of a repository which conceivably might lead to exposures after many thousands of years considerably higher than background to individuals who dig water from the immediate environs of the repository.

The most notable such estimate comes from a 1983 National Academy report in which such exposures could not be absolutely ruled out. But the likelihood, I would argue, is minuscule, and the time for them to occur is extremely long, of the order of many thousands of years.

Well, are there approaches to waste disposal which would lay to rest even such residual concerns? The possibility of a repository being flooded, then mining the groundwater in the immediate vicinity of the repository?

I remind you that the safety of waste disposal is based on several barriers blocking the path from radioactive waste to the biosphere.

These barriers are the waste form itself, sintered UO_2 in the case of unreprocessed fuel, or borosilicate glass for reprocessed wastes;

two, the container; three, the overpack and backfill; and four, the geological environment.

A radioactive atom must traverse each of these barriers if it is to reach the biosphere.

The United States waste program has, from the beginning, emphasized the geologic emplacement as perhaps the primary barrier to incursion of the wastes on the biosphere. This is not to say that waste form or canister have been ignored.

But I have the impression that the geologic barrier salt, tuff, basalt, has been the main focus of the effort.

I have no quarrel with the emphasis placed on the geologic barrier. However, to prove that the geologic barrier will work as planned and as calculated in the various waste scenarios is not easy.

Geology and hydrology are less understood, are less easy to understand, than is chemistry and physics.

I would therefore suggest the Office of Civilian Radioactive Waste Management ought to devote even more effort than it is now to develop what I would call inherently safe waste disposal schemes, that is, schemes whose safety depends less centrally on the difficult to understand and often controversial geology and hydrology, and more upon the easier to understand and less controversial chemistry and physics.

What this amounts to is developing waste packages, waste forms, canisters, and overpack, that are completely resistant even if the repository is invaded by water, for much longer than the 300,000 years required by the NRC.

We are not able to say how long is long enough, especially since the existing systems designed for 300,000 years are already safe enough, a point that really should be kept in mind; that if you look at the total radioactivity from a repository that includes all of the wastes from all of the reactors that are now operating, and compare that total radioactivity with the radioactivity in the original uranium that was mined, they're of the same order of magnitude.

I'm not saying that they're exactly equal, or in fact, that the hazards of the different radio nuclides are identical with those in ordinary uranium ore.

But that gives you a sense of where one is; that after a few thousand years, you're at the same level, within, say, a factor of five or so, of the radioactivity that was there to begin with.

And that must always be kept in mind. And I think that this, to my mind, is the ultimate reason why, despite the fact that I say there are some questions about geology, it's a hard thing to model, I feel very comfortable about the whole situation.

Now, as I said, the systems depend ultimately for their safety on geology and hydrology. And what I suggest is that systems that depend for safety less on geology and more on chemistry ought to be less subject to dispute by nuclear skeptics.

Sweden has developed such an approach. It plans to encase spent fuel in stout copper canisters. These are to be placed in geologic strata where native copper is found. The existence of native copper is prima facie evidence that the groundwater would not attack the waste canister.

The Swedish public seems to have bought this scheme as satisfying a legislative requirement for, and I quote from the enabling act in Sweden, certainly safe waste disposal.

Originally they used the words, absolutely safe. But on reflection, this was changed to certainly safe.

Several technical paths towards achieving a chemically safe, that is, an inherently safe waste package, might be considered.

For example, several suggestions for sintered aluminum oxide, that is sapphire cans, have been put forward on the ground that sapphire is totally resistant to groundwater in many environments.

But I do not want to guess what a chemically safe package might be. I do insist that Sweden has come up with a chemically safe package, and the Swedish public seems to agree with the judgment that copper cans are chemically safe.

I therefore urge the Office of Civilian Radioactive Waste Management to pay more attention to the development of a chemically safe package, one that would last for example for 10,000 or even more years in a flood hydrologic environment.

In this connection I was pleased to learn that the Office of Civilian Radioactive Waste Management, in response to a directive of the Senate, S.R. 98-502, page 163, has conducted a two-year study of the use of copper containers in basalt and tuff.

Conclusions of the study have been favorable. The general thrust of my recommendation is simply that I believe the Office of Civilian Radioactive Waste Management ought to strengthen efforts such as this, assuming the experimental results are favorable, to convey to the public an understanding that the inherent or chemical safety of the waste package confers an additional margin of safety, on a system that in my view and in view of almost every other technical expert, is already extremely safe.

Should this approach be successful, then it probably means that the waste will have to cool above ground about 50 to 100 years, rather than the originally designed 10 years.

At the end of 100 years, heat produced per minute by a spent fuel element is only one-fourth the heat produced after 10 years. And this simplifies repository design, and all but eliminates a variable, temperature, from consideration.

I'd like now to talk about compensation. I don't know whether incorporating the requirement of chemical safety in the repository design will change the minds of the many people who hate all things nuclear, and especially, nuclear waste.

I propose the approach not because I believe it is necessary to assure a technical person like myself that the repository is safe, but rather that in lessening dependence on difficult to define geologic and hydrologic processes, and increasing dependence on chemistry, we can make an easier case for convincing the public of the safety of the repository.

Anyone can understand, if the can never leaks, no one can be harmed. It takes more sophistication to realize that some geologic barriers are also all but impossible to fail catastrophically.

The issue then is one of public perception. I've already alluded to the importance of the public's understanding of the insignificance of low levels of radiation. But even this may not be enough.

I'm therefore very pleased to learn that the proposed modification of the Nuclear Waste Policy Act proposes generous compensation for a state willing to accept the repository.

I believe the compensations should be awarded to a state in which the repository is located, regardless of the state's attitude. That is, I do not believe it wise to require public enthusiasm for a repository on the part of state politicians as a qualification for compensation.

We must not put politicians in untenable hardened positions, even with compensation and chemically safe waste.

I doubt that the repository or the MRS will be welcome, at least at the outset. I think it is asking too much of a politician to actually ask for a repository. On the other hand, with the compensation, I should think, politicians could maintain a kind of neutrality, even benevolent neutrality, without jeopardizing their own political future.

In conclusion, I should make clear that from a purely technical view, the presently proposed system, with its strong reliance on geologic safety, is adequately safe. Nevertheless, I favor continued and increased emphasis on developing of inherently chemically safe waste packages, as a means of further reassuring a skeptical public.

Finally, I strongly approve the principle of compensation to the state and locale that is host to a repository, although I believe it unwise to make such compensation contingent on the enthusiasm with which the host state accepts the repository.

Thank you, Mr. Chairman.

[The prepared statement of Dr. Weinberg follows:]

TESTIMONY ON NUCLEAR WASTE DISPOSAL

Alvin M. Weinberg
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P.O. Box 117
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My name is Alvin Weinberg. I have been associated with the nuclear energy enterprise since its beginning, even before the first chain reaction was established in 1942. I was Director of the Oak Ridge National Laboratory from 1955 to 1974; I was Director of the Office of Energy Research and Development in the Federal Energy Office, later the Federal Energy Administration, in 1974. From 1975 to 1985 I directed the Institute for Energy Analysis. I am now a Distinguished Fellow of the Institute. I have been involved in the problem of waste disposal, mainly as a laboratory administrator, since the early 1950s. However, I do not regard myself as a specialist in waste disposal; my technical knowledge of the field derives from long association with people at Oak Ridge National Laboratory who were responsible for laboratory programs in waste disposal.

As early as 1952, Prof. James Conant, President of Harvard and President Roosevelt's wartime advisor on atomic energy, predicted that the world would turn away from nuclear energy because the problem of waste disposal would prove to be intractable. A good part of my energy, as director of the Oak Ridge National Laboratory, was directed toward proving that Professor Conant was wrong.

And indeed, if one were to judge by the estimates of most technical people, radioactive waste disposal is, almost without exception, not regarded as being a particularly difficult technical problem. It does not, for example, compare in difficulty, with the problem of reactor safety. In the latter case, nuclear experts had realized from the outset that a reactor, generating enormous amounts of heat (which cannot be turned off) could be a serious hazard. In the case of the wastes, the heat generated is far smaller: there is not powerful driving force, which, if uncontained, could cause massive spread of radioactivity.

Why then has the radioactive waste issue evoked such bitter opposition on the part of the public until Three Mile Island and Chernobyl, it evoked much greater public concern than had the issue of reactor accident? I believe one important reason is the widespread misunderstanding as to the hazards of low levels of radiation. There is essentially no credible scenario connected with the entire waste disposal cycle--temporary storage above ground, transport, final disposal in a geologic depository--which imposes on any individual a really large dose of radiation. This contrasts sharply with reactor accidents: at Chernobyl, for example, many people received lethal doses of radiation. I believe the public, in expressing its fear of nuclear wastes, tends to compound possible releases from a waste depository with the far more lethal releases from an uncontained reactor accident. Until and unless the public understands that doses of the order of background inconsequential, waste disposal, even nuclear energy itself, will founder. I therefore applaud attempts to educate the public as to the insignificance of radiation exposure at the level estimated to come from a repository.

In all fairness, there have been a few very improbable scenarios involving flooding of a repository which conceivably might lead to exposures, after many thousands of years, considerably higher than background. The most notable such estimate comes from a National Academy Report in which such exposures could not be absolutely ruled out, though the likelihood is miniscule, and the time for them to occur, extremely long.

Are there approaches to waste disposal that would lay to rest even such residual concerns? I remind you that the safety of waste disposal is based on several barriers blocking the path from radioactive waste to the biosphere. These barriers are (1) the waste form itself--sintered UO_2 in the case of unreprocessed fuel, borosilicate glass for reprocessed wastes; (2) the container; (3) the overpack and backfill; (4) the geologic environment. A radioactive atom must traverse each of these barriers if it is to reach the biosphere.

The U.S. waste program has, from the beginning, emphasized the geologic emplacement as perhaps the primary barrier to incursion of the wastes on the biosphere. This is not to say that waste form or canister have been ignored. But I have the impression that the geologic barrier salt, tuff, basalt--has been the main focus of the effort.

I have no quarrel with the emphasis placed on the geologic barrier. However, to prove that the geologic barrier will work as planned, and as calculated in the various waste scenarios, is not easy: geology and hydrology are less easy to understand than is chemistry and physics.

I would therefore suggest that the Office of Civilian Radioactive Waste Management ought to devote even more effort to developing what I would call "inherently safe waste disposal schemes"--that is schemes whose safety depends less centrally on the difficult to understand, and often controversial, geology and hydrology and more upon the easier to understand and less controversial, chemistry and physics. What this amounts to is developing waste packages (waste forms, canisters, and overpacks) that are completely resistant even if the depository is invaded by water, for much longer than the 300-1000 years required by the NRC.

I am not able to say exactly how long is long enough--especially since the existing systems, designed for 300 to 1000 years, are already safe enough. But these systems depend for their ultimate safety on geology and hydrology. I suggest that systems that depend for safety less on geology and more on chemistry ought to be less subject to dispute by nuclear skeptics.

Sweden has developed such an approach: it plans to encase spent fuel in stout copper canisters. These are to be placed in geologic strata where native copper is found: the existence of native copper is prima facie evidence that the groundwater in the repository would not attack the waste canister. The Swedish public seems to have bought this scheme as satisfying a legislative requirement for "certainly safe" waste disposal.

Several technical paths toward achieving a "chemically" safe--i.e., an inherently safe waste package might be considered. For example, the sintered UO_2 itself apparently completely binds plutonium and other transuranics; thus the National Academy study may have been much more pessimistic than was justified in this respect. Again, several suggestions for sintered aluminum oxide--i.e., sapphire--cans have been put forward on the ground that sapphire is totally resistant to groundwater in many environments. But I do not want to guess what a chemically safe package might be: I do insist that Sweden has come up with a chemically safe package; and the Swedish public seem to agree with the judgment that copper cans are chemically safe. I urge OCRWM to pay more attention to the development of a chemically safe package--one that would last, for example, 10,000 or more years even in a flooded hydrologic environment.

In this connection I was pleased to learn the OCRWM, in response to a directive of the Senate (S.R. 98-502, p. 163) has conducted a two-year study of the use of copper containers in basalt and in tuff. The conclusions of the study have been favorable. The general thrust of my recommendation is simply that I believe OCRWM ought to strengthen efforts such as this; and, assuming that the experimental results are favorable, to convey to the public an understanding that the inherent or chemical safety of the waste package, confers an additional margin of safety on a system that is already extremely safe.

Should this approach be successful, then it probably means that the waste will have to cool aboveground about 50 to 100 years, rather than the originally designed 10 years. At the end of 100 years, the heat produced per minute by a spent fuel element is only one-fourth the heat produced per minute after 10 years. This simplifies repository design, and all but eliminates a variable--temperature--from consideration.

- Compensation -

I do not know whether incorporating the requirement of chemical safety in the repository design will change the minds of the many people who hate all things nuclear and especially nuclear wastes. I propose the approach not because I believe it is necessary to assure a technical person like myself that the repository is safe; it is rather that, in lessening dependence on difficult to define geologic and hydrologic processes, and increasing dependence on chemistry, we can make an easier case for convincing the public of the safety of the depository. Anyone can understand that if the can never leaks, no one can be harmed. It takes more sophistication to realize that some geologic barriers are also all but impossible to fail catastrophically.

The issue then is one of public perception. I have already alluded to the importance of the public's understanding the insignificance of low levels of radiation. But even this may not be enough. I am therefore very pleased to learn that the proposed modification of the Nuclear Waste Policy Act proposes generous compensation for a state willing to accept a repository.

I believe the compensation should be awarded to a state in which the depository is located regardless of the state's attitude. That is, I do not believe it wise to require public enthusiasm for a repository on the part of state politicians as a qualification for compensation. We must not put politicians in untenable, hardened positions. Even with compensation and chemically safe wastes, I doubt that the repository or the MRS will be welcomed, at least at the outset. I think it is asking too much of a politician to actually ask for a repository. On the other hand, with compensation I should think politicians could maintain a kind of neutrality, even benevolent neutrality, without jeopardizing their own political futures.

- Conclusion -

In conclusion, I should make clear that, from a purely technical viewpoint, the presently proposed system, with its strong reliance on geologic safety, is adequately safe. Nevertheless I favor continued and increased emphasis on development of inherently, chemically safe waste packages as a means of further reassuring a skeptical public. Finally, I strongly applaud the principle of compensation to the state and locale that is host to the repository, though I believe it unwise to make such compensation contingent on the enthusiasm with which the host state accepts the repository.

AMW/an
04/87

The CHAIRMAN. Thank you very much, Dr. Weinberg. Your statement is very helpful to us. I hope it will be listened to and heeded throughout the country from someone with your background and your expertise.

It was a curious thing to us. We just got back from Sweden and France looking at their nuclear waste facilities there. And the contrast between public attitudes in Sweden and in France and the United States was stark.

For example, we met with members of Parliament from Oskarshamm and Forsmark, the two nuclear waste facilities in Sweden. And they were not only willing in their acceptance, but enthusiastic in their acceptance of nuclear waste.

Indeed, the member of Parliament from Oaskarshamm was asking SKB, the Swedish utility, to put in their permanent repository there because the jobs were good.

Now, I don't know how we've gotten so wrapped up in this mysticism and this almost voodoo like fear of nuclear waste in this country.

It is amazing. Maybe it is, in our desire to make it so safe and talk about absolute barriers for hundreds of thousands of years, we have created—by trying to be so safe, we have created the view that that kind of danger exists.

And indeed, I think perhaps Senator McClure and I, in having our recompense package, may give the people the idea that really there's a hundred million dollars a year of damage that will actually be inflicted.

But what you're saying, Doctor, is that it really is no scientific problem as you see it, the disposal of nuclear waste?

Dr. WEINBERG. That's my judgment, though I would perhaps point out that at the time the decision to build the CLAB facility at Oskarshamm and go ahead with waste disposal in Sweden, before that there was very vigorous argument about waste disposal.

And the argument as I recall finally came to an end when KSB, the Swedish waste disposal company, decided to go for these perfectly safe, or certainly safe, copper containers; in which case they no longer had to argue about the hydrology or the geology. The containers themselves were perfect; or not perfect, but certainly safe.

And I guess what I'm saying is that I believe that the hydrology and geology of the waste sites will be perfectly adequate.

In every study, even including this National Academy study that I referred to, says that with any plausible or even implausible scenario, nobody is going to get hurt.

But it's a little bit difficult to convince the public of that point. And it's on this account that I would urge Ben Rusche and the people in OCRWM to take perhaps another look at following more strongly along the Swedish direction.

Incidentally, I take it, Senator Johnston, that you did actually see an MRS in being and actually working in Sweden. And in fact, the people the people at Oskarshamm loved the MRS.

Perhaps we ought to send all of my fellow Tennesseans to Oskarshamm to see how good an MRS can be.

The **Chairman**. Well, we did indeed see the MRS, both in Sweden and in France. And they very successfully handled the problem.

I take it you do think the MRS is a very good idea to cool the waste down both in waste heat and in radioactivity so as to minimize the engineering problem of handling hot waste?

Dr. **Weinberg**. I've gone on record as saying on balance, and given the nontechnical situation that now exists, the question of public perception and so on, that I am favorably inclined toward building the MRS and getting on with it.

The **Chairman**. Doctor, one final question——

Dr. **Weinberg**. And let me say, this is particularly the case, because I believe that the 10-year waiting time, which was the original design criterion—perhaps Ben Rusche can tell me whether OCRWM still inclines toward that—I think that's too short.

The Swedes, you know, are going for 40 years. I'd be prepared to go for 50 or 100 years. That simplifies the design of the repository.

The **Chairman**. I very much agree with that.

One final question, Dr. Weinberg, and that has to do with the cost.

In Sweden, as I recall, Forsmark, which involves four or five kilometers of underground tunnels, and I think they were 30 meters under the sea—now, 150 meters underground, and 3.5 kilometers of tunnels, plus the storage facilities themselves—they built for $100 million.

We went under there. They drive trucks under there. We went down in a big bus.

Now, in France, they plan characterization at one site, where they're going to sink a deep shaft and have a laboratory down there in operation for a sufficient length of time to prove the geologic characteristics. Plus they're going to do additional characterization at four sites involving the sinking of drill holes.

They plan to spend $70 million for the characterization and the underground lab, and $10 million per site.

At the CLAB facility in Oskarshamm, they have in operation—in operation—3,000 tons of capacity, which they built for $250- to $300 million.

In France, at Le Hague, 6,000 tons of capacity in operation, that's going to be a few hundred million, we don't know exactly how much.

Now, that compares with the cost of characterization in this country of a billion or more at three sites—each, at three sites. They're spending hundreds of millions of dollars, and I don't know what, in God's name, they're doing with that money.

Maybe Ben Rusche, whom I very strongly support, and who is a great man, but boy you spend that money. The French told us, we asked them, do you know why we spend so much money in the United States?

They said, no, they said, we have sort of a rule of thumb that what we can do for a frank, it costs you a dollar in the United States.

Dr. **Weinberg**. That goes for reactors too, by the way.

The **Chairman**. And that's on a six to one. The dollar's dropping now; maybe we'll close the gap.

Do you have any reason—can you give us any reason why that is so?

Dr. WEINBERG. I don't really have any good answer to that that I can give in a short time, Mr. Chairman. As you, I would defer to my good friend Ben Rusche to answer that.

The CHAIRMAN. Well, one of the Swedes said, one of them who was very knowledgeable who had spent a lot of time in this country, he said, well, you know, if private enterprise does it, then you have the profit motive which is looking after your dollars, and when the government usually does something, you've got the curmudgeons over in OMB looking at it, but when it comes to nuclear waste, nobody's looking after it except—I mean from the standpoint of dollar safety.

They always say, well, gold plate it. You know, if you need it safe, have ten redundancies. Maybe that's the reason. Not that I want to get OMB in this program, but maybe we need someone to look at it.

Senator McClure.

[The prepared statement of Senator McClure follows:]

OPENING STATEMENT - SENATOR JAMES A. MCCLURE

APRIL 28, 1987

TECHNICAL ISSUES - CIVILIAN NUCLEAR WASTE DISPOSAL PROGRAM

GOOD MORNING. I APPRECIATE THE DILIGENCE SHOWN BY THE CHAIRMAN IN SCHEDULING THE THREE HEARINGS THIS WEEK DEALING WITH SPECIFIC ISSUES RELATED TO THE DISPOSAL OF NUCLEAR WASTE.

IN THE NUMEROUS HEARINGS THAT WE HAVE HELD OVER THE PAST SEVERAL YEARS CONCERNING THE IMPLEMENTATION OF THE NUCLEAR WASTE POLICY ACT, WE HAVE MORE OFTEN THAN NOT TENDED TO FOCUS ON POLITICAL, INSTITUTIONAL, PROGRAMMATICAL, SCHEDULING, AND FISCAL ISSUES RELATED TO THE NUCLEAR WASTE DISPOSAL PROGRAM. WE HAVE NOT TENDED TO GIVE TECHNICAL ISSUES THEIR PROPER FOCUS, UNENCUMBERED AND UNADULTERATED BY THE OTHER ISSUES I MENTIONED.

PARTICULARLY IN LIGHT OF WHAT WE OBSERVED AS A RESULT OF THE RECENT CONGRESSIONAL TRIP TO SWEDEN AND FRANCE, I FEEL IT IS TIME THAT WE GIVE THE TECHNICAL ISSUES THE ATTENTION THEY DESERVE. FOR DESPITE ALL THE OTHER PROBLEMS WE WILL HAVE TO OVERCOME IN THIS PROGRAM, IF WE CANNOT POINT TO THE TECHNICAL SOUNDNESS OF THE PROCESS, THEN WE HAVE NOTHING.

BASED ON THE PROGRESS THAT WE OBSERVED IN THE SWEDISH AND FRENCH PROGRAMS, I AM CONVINCED NOW MORE THAN EVER THAT THE TECHNICAL CHALLENGES IN NUCLEAR WASTE DISPOSAL CAN BE MET, AND DO NOT REQUIRE PARTICULARLY EXOTIC SOLUTIONS. FURTHERMORE, THE TECHNIQUES EMPLOYED FOR TRANSPORTATION AND STORAGE OF NUCLEAR WASTE AND SPENT FUEL ARE WIDELY ACCEPTED PRACTICES SUBSTANTIATED BY YEARS OF EXPERIENCE IN

THE SAFE HANDLING OF NUCLEAR WASTES WITHIN THESE COUNTRIES. AS AN EXAMPLE, THE FRENCH HAVE BEEN SHIPPING SPENT FUEL FOR YEARS, USING CASKS SIMILAR IN DESIGN TO WHAT IS CONTEMPLATED HERE, AND THEY HAVE EXPERIENCED NO ACCIDENTS IN OVER 3,000 SHIPMENTS TO DATE.

WHILE THIS COUNTRY ARGUES AND DEBATES OUR CAPABILITY TO SAFELY TRANSPORT, STORE, AND DISPOSE OF OUR INVENTORY OF NUCLEAR WASTE, SWEDEN AND FRANCE ARE ACTUALLY GETTING THE JOB DONE. WE SHOULD LOOK TO THEIR LEADERSHIP AND EXPERIENCE AS THE ROLE MODEL OF WHAT CAN BE DONE HERE, IF WE CAN MUSTER THE WILL TO PROCEED.

WHILE THE INDIVIDUAL COMPONENTS OF THE FRENCH AND SWEDISH PROGRAMS MAY DIFFER SOMEWHAT FROM OURS, THERE IS ONE UNIVERSAL GOAL THAT MUST DRIVE ALL ELEMENTS OF ANY WASTE DISPOSAL PROGRAM, AND THAT GOAL IS TECHNICAL EXCELLENCE. I AM HOPEFUL THAT TODAY'S HEARING WILL SHED LIGHT ON THE TECHNICAL SOUNDNESS OF OUR PROGRAM, SO THAT WE CAN MOVE AWAY FROM THE CYNICAL QUESTIONS ABOUT HOW THINGS MIGHT GO WRONG WITH THE PROGRAM, AND MOVE ON TO THE MORE CONSTRUCTIVE QUESTIONS ABOUT HOW TO MAKE SURE, FROM A TECHNICAL STANDPOINT, THAT THINGS GO RIGHT WITH THE PROGRAM.

Senator McClure. Dr. Weinberg, of course I appreciate your testimony. And I can't help but applaud your focus on two things. One is, make the cannister inherently safe. You don't have to worry quite so much about the geologic media.

And the second is, the necessity for public understanding. Certainly, you have in your lifetime done your share to try to get the public to understand, but we seem to be losing the battle anyhow.

And so these hearings provide an opportunity for us to focus again on the relative risks that are involved. And I appreciate your testimony, particularly in that regard, because you have immense credentials.

You have credibility for anyone who wishes to listen. But we must recognize that there are a great many who don't want to listen. They have their minds made up. They have their emotions in place.

They have no intention of changing their mind in any respect, no matter what evidence is brought forward. That group of people, unfortunately, we can't change.

But we must work on the margins of public opinion that can be changed. We must work also with the scientific community that must understand that in our kind of government, that indeed, public opinion does matter, and that the public perceptions, even if they're erroneous, change public policy.

So we have an immense public relations, public education problem.

I have one question that derives from both your testimony and the answer to the question that the Chairman had just put to you with respect to the length of time that we ought to allow to pass before even attempting to place wastes in permanent repositories.

You have suggested 100 years in your testimony. If I recall your answer to the question correctly, you said you could be comfortable with 40 to 50 years.

As I understand the Swedish program calls for 30-40 years before they encapsulate the waste. And you mentioned the engineering difficulty—or put it the other way, the passage of time makes the engineering problem easier.

Is there a very large engineering problem at 30-40 years, as compared to 100 years?

Dr. Weinberg. Well, it's a matter of the design of the repository. In principle, one can stay at 10 years, if one dilutes the wastes sufficient. For example, if one is going to dispose of fuel elements themselves, then in principle it would be possible to disassemble each fuel element and take out each rod and put each rod separately in a cannister.

But that would be very expensive. And so that's a matter entirely of engineering judgment.

I guess the main point I was making is that those who object to the design of repositories on the basis that the 10 years is a sacred number, and that therefore the temperature rises will be of the order of perhaps 200 degrees Centigrade, they don't understand the problem.

They don't realize that that temperature rise is an engineering variable, and that Ben Rusche can, in looking at his engineering analyses, decide how much temperature he believes is acceptable, and then say, well, we'll keep the stuff above ground for so many years, so that that will be the temperature that the repository will rise to.

That's my main point. You see some of the objections to some of the previous ideas for disposal were made by, I might say, people from the U.S. Geologic Survey for example, a study that came out some 10 years ago or more, 15 years ago.

And they took the 250 degree Centigrade rise as an article of faith, not realizing that that was an engineering variable. And that by keeping the stuff above ground, you could make that much lower.

Senator McClure. All right. If I could put that in slightly different terms which I as a layman might understand a little better, the stuff cools off over time.

Dr. Weinberg. Right.

Senator McClure. Both thermally and radioactively.

Dr. Weinberg. Yes.

Senator McClure. The longer you keep it above ground, the less difficult it is to store it.

Dr. Weinberg. Right, correct. And that of course is one of the reasons why, although on some occasions I have argued that, keep the stuff above ground at the sites, I am inclined in the current situation, with the current environment and so on, to support the MRS, because if, say, you think about keeping the stuff above ground for maybe 50 years or possibly longer, you begin worrying about the institutional integrity of a whole bunch of dispersed sites that are that long-lived, whereas, it's much easier to conceive of the institutional integrity over a period as long as 100 years if you have it in one place, and the government is really involved.

Senator McClure. Well, let's assume that you keep spent fuel assembly at a pool or in an MRS, whatever its design might be, for 30 years.

What is the temperature of that fuel assembly after 30 years?

Dr. Weinberg. Well, I don't have those numbers precisely in mind. As I recall, for 100 years, the difference in heat production is almost a factor of ten.

Now, it's a little different whether it's fuel assemblies or reprocessed waste. I would offhand guess, although this is just a guess, the difference between ten years and thirty years or forty years, is about a factor of 2½ in heat production.

And that, roughly, is proportional to the temperature rise in the repository.

Senator McClure. Well, as I recall, and we'll get to this later on, I don't mean to belabor that subject, but as I recall, after having visited an experimental repository in Nevada, which incidentally has been there for quite a little while, the spent fuel cannister—spent fuel assembly being placed in the cannister had 600 watts thermal at the time it was placed in the cannister in that area.

Does that sound reasonable to you?

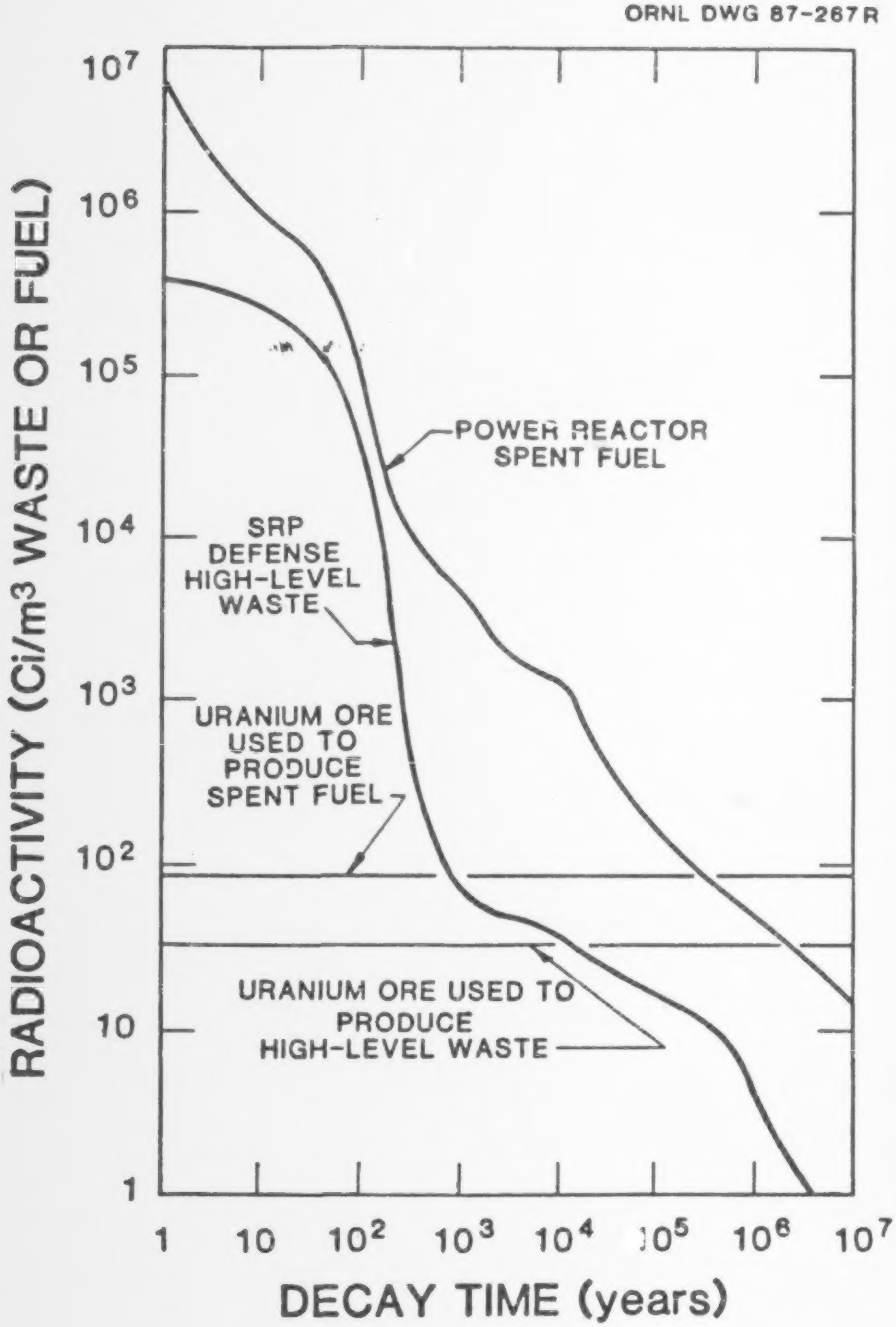
Dr. Weinberg. That means, I believe, that it has cooled for a fair amount of time. Oh, here we have it. Well, the difference between ten years and ten times that is about a factor of ten.

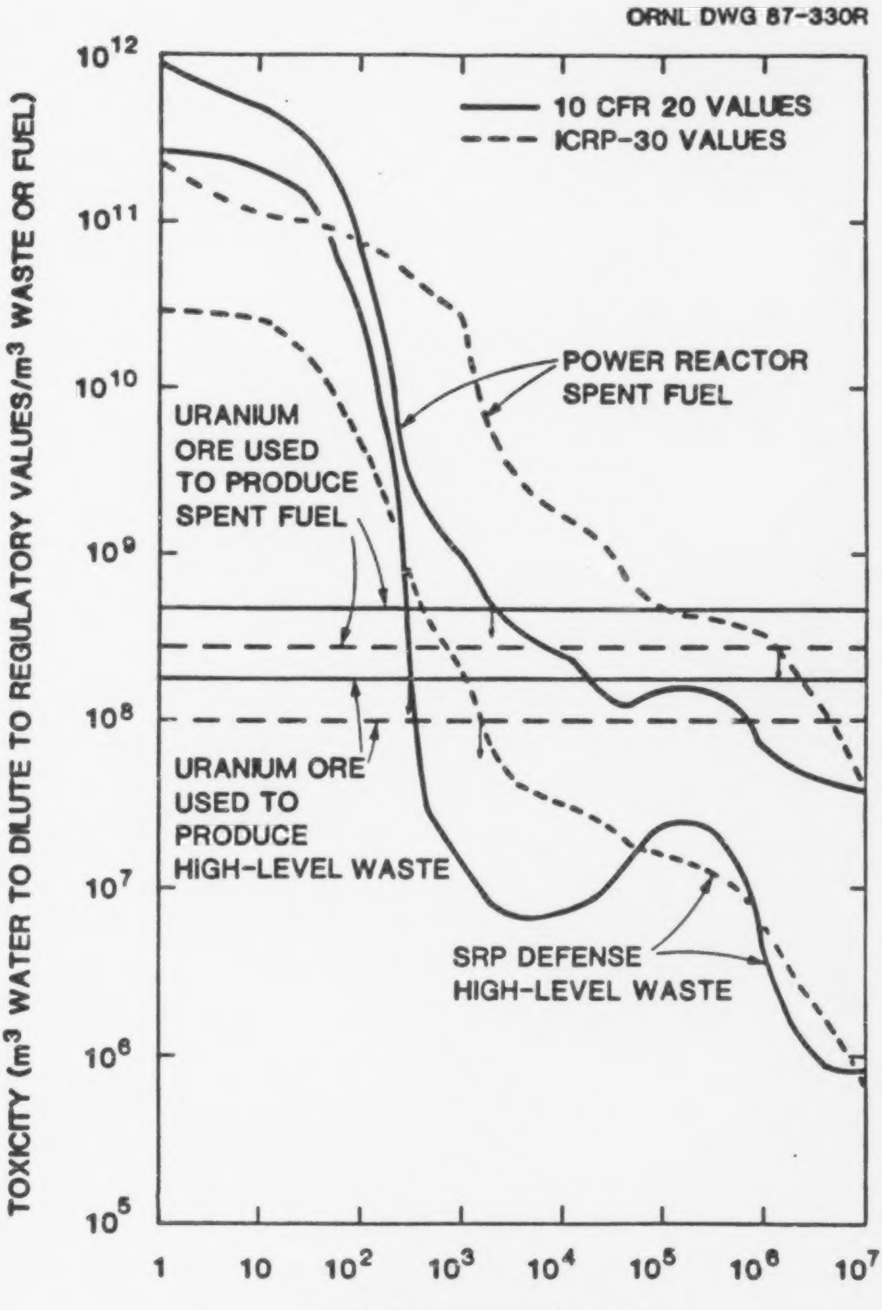
Six hundred watts per fuel assembly, a little bit low for fresh fuel. For fresh fuel, it's around 5 kilowatts, perhaps eight times higher than that.

Senator **McClure**. Mr. Chairman, I would ask unanimous consent that the graphs that illustrate the decay heat, decay time, be made a part of the record.

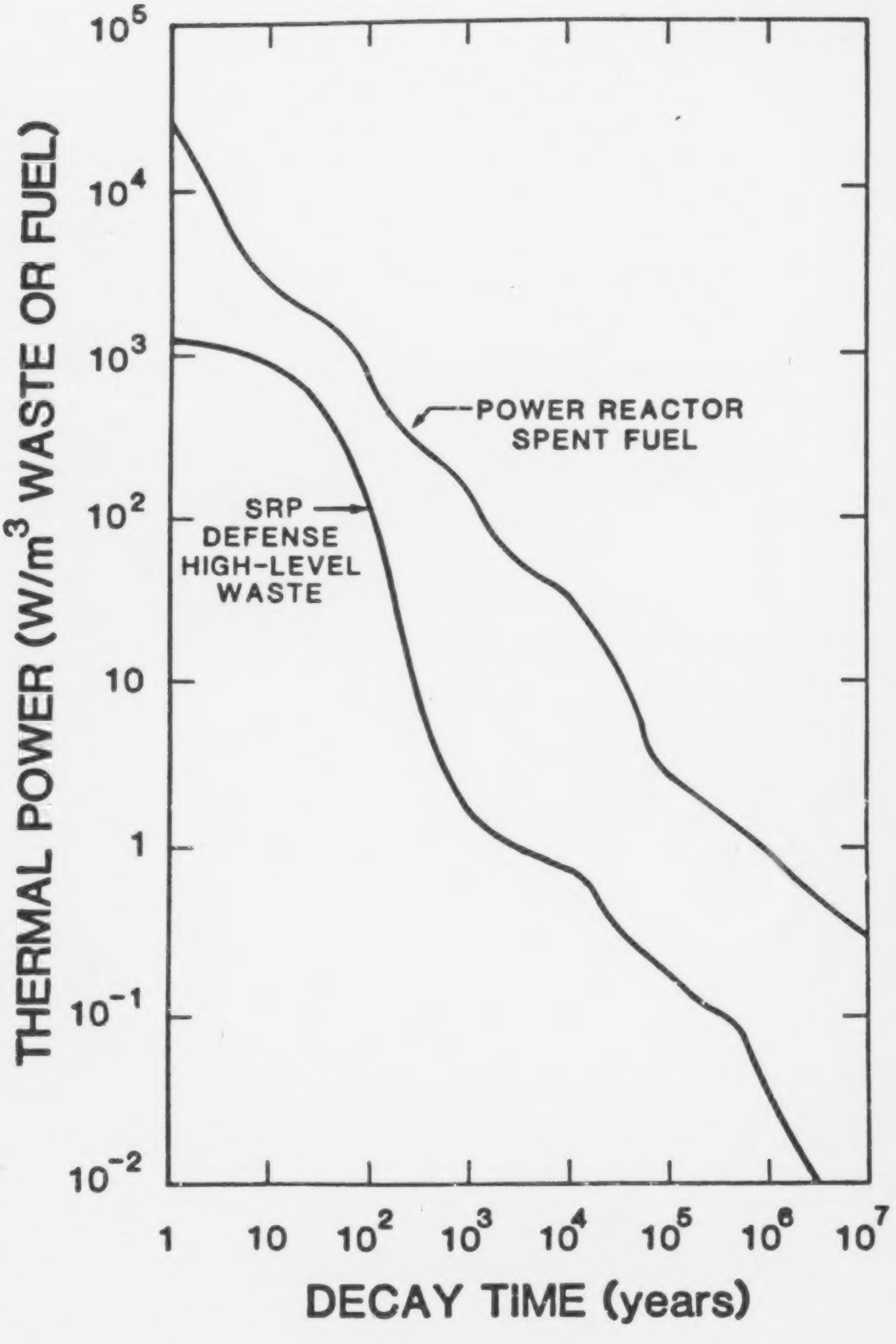
The **Chairman**. Without objection.

[The graphs referred to follow:]


ORNL DWG 87-267R
RADIOACTIVITY (Ci/m³ WASTE OR FUEL)
10⁷
10⁶
10⁵
10⁴
10³
10²
10
1
DECAY TIME (years)
1
10
10²
10³
10⁴
10⁵
10⁶
10⁷
POWER REACTOR SPENT FUEL
SRP DEFENSE HIGH-LEVEL WASTE
URANIUM ORE USED TO PRODUCE SPENT FUEL
URANIUM ORE USED TO PRODUCE HIGH-LEVEL WASTE


ORNL DWG 87-330R
10 CFR 20 VALUES
ICRP-30 VALUES
POWER REACTOR SPENT FUEL
URANIUM ORE USED TO PRODUCE SPENT FUEL
URANIUM ORE USED TO PRODUCE HIGH-LEVEL WASTE
SRP DEFENSE HIGH-LEVEL WASTE
TOXICITY (m³ WATER TO DILUTE TO REGULATORY VALUES/m³ WASTE OR FUEL)
10¹²
10¹¹
10¹⁰
10⁹
10⁸
10⁷
10⁶
10⁵
1
10
10²
10³
10⁴
10⁵
10⁶
10⁷
DECAY TIME (years)

ORNL DWG 87-265 R



Senator McClure. I think it's important for people to understand the difference between a fuel assembly producing heat in a reactor, and a fuel assembly after it's been taken out and cooled down for a period of time, and the difference in difficulty of handling and storing heat.

Dr. Weinberg. Well, that bears on the point that I wanted to insist on, the difference between the waste disposal problem and the reactor problem.

With the reactor, you have an enormous energy generating force, a driving force that you have to keep under control all the time. In the case of the wastes, you don't have that driving force, and people must recognize that.

Senator McClure. Dr. Weinberg, I appreciate your testimony. I would just express one additional reason why I personally have always favored an MRS.

We as a country have decided that for now we will not do spent fuel reprocessing. I am offended by a process that, taking from uranium ores, uses 1.5 percent of the potential energy, and regards all the rest as not only a problem but a waste, rather than an asset.

There's an awful lot of asset value in spent fuel in terms of energy production. I've forgotten the exact figures now. But as I recall, you mine uranium, put it through a milling process, produce yellow cake and all the rest that came out of the mine that isn't in the yellow cake now becomes a radioactive waste.

It's stored in 55-gallon drums, as I recall, in various places around our country. The potential energy in those 55-gallon drums is, today, on today's world energy market, worth about $3 trillion.

And we call it waste. And we call it a problem. And I just wonder if we shouldn't be looking at some of these substances for their potential value in the future, rather than simply their potention problem at some point in the future.

And an MRS gives you more flexibility to make those choices, as the world's economy and the world's energy demands and the world's technology changes over time.

Dr. Weinberg. I couldn't agree more with you, Mr. McClure.

Senator McClure. Thank you very much, Dr. Weinberg.

The Chairman. Senator Evans? I think you were here before Senator Ford.

Senator Ford. Absolutely. I want to compliment the Senator on being here early.

Senator Evans. I thank the Senator.

Dr. Weinberg, in a few short minutes, you've spoken more sense and more cogently and clearly than in acres of testimony we have had, especially from groups outside the government who I think have hard information, misinformation, some of it passed along inadvertently, and some of it I think used deliberately in an attempt to kill once and for all nuclear power.

Let me continue with what—and I must say that I thoroughly agree with my colleague from Idaho in terms of the MRS concept. It was strongly enhanced by our visits to Sweden and to France, where in both cases, as we've said, they already have those facilities in being; they are adequately handling the waste for an extended period of time; they are continuing their work toward a geologic repository.

But in the meantime, they are far better than we are in our current activity.

And I don't say that by indicating that we were necessarily wrong in the Nuclear Waste Policy Act of 1982. I think we did what we thought best at that time.

I would liken it in a football game, we were trying for a touchdown pass, and we got intercepted, or more accurately, we fumbled before we even passed.

And I think we ought to be trying for good, solid first downs, one by one, to score a touchdown. And the first down, it seems to me, is to adequately handle the waste at a central collecting point through an MRS.

In France, we visited their MRS. In fact, walked the floor without protection right over the place where the casks were buried, an indication that at least the French didn't think we were in any danger.

The wine tasted better after that.

But they indicated that in their case they were depending on air cooling, forced air convection for the first four or five years, and said after that the heat had declined sufficiently so that the natural convection of the remaining heat was sufficient and they could shut off all of their machines and, in other words, let it bake naturally, and it would cool itself naturally.

It seems to me that that indicates, once again, very strongly the desirability of intermediate storage for an extended period of time as a way to sufficiently cool these wastes.

And I guess that's a statement more than a queston, but wouldn't you agree?

Dr. **Weinberg**. I don't think there's any argument about that. The only argument, of course, is it more cost-effective, is it equally good, to build 100—well, not 100, but 80 little MRSs on each reactor site, as opposed to one big MRS, and that's an arguable point.

And at one point I favored 80 little MRSs, but looking at how the situation politically and emotionally has developed, I have come around to support quite strongly Ben Rusche's proposal to build a single MRS.

And the fact that France and Sweden have gone ahead and done it, and there's no big hassle about it, it's quite astonishing.

Senator **Evans**. What would you think of a concept, if we were going to store for a longer period of time in an MRS, up to even the 100 years that you have suggested, would it make sense then to consider not just one but perhaps a series of three or four regional MRSs, each one to collect materials from within that region of the Nation, to not require that an extraordinary amount of material be collected in one place, and that in that way, you could both minimize transportation distances and have an adequate by sized but perhaps not super-sized MRS, if we're talking about these long periods of time?

Dr. **Weinberg**. Well, I don't think I ought to try to give an answer to that, because that's a somewhat complicated question that would come out of whatever systems analysis one can make of the whole system.

And indeed, it depends to some degree on one's point of view as to the future of nuclear energy in the United States. My own fear is that unless we do something, say, about public understanding of nuclear energy, we may find that we will have to give up the nuclear option in the United States, which I think is a terrible, terrible thing to contemplate.

But I would defer on this to the OCRWM's analysis of how many MRSs make the most sense. Maybe more than one.

Senator Evans: All right, let me turn to the question of reprocessing. The testimony we received from the French indicated that in their reprocessing, they drastically reduce the volume of the waste to be stored, mostly because they extract the fuel from the fuel elements, and reprocess; they chop the fuel elements and reduce their volume as a result; in fact, they intend eventually to solidify those remaining fuel rods into ingots, and would end up with something like 20 percent or less after consolidation of the waste than the volume of waste we are faced with, by just storing unprocessed spent fuel.

They further indicated that in reprocessing you, by definition, are separating out the hottest waste, which is also the shortest lived, because it is highly radioactive, it has short half-lives.

The longer half-lives are the plutonium and associated radio nuclides that they put back into a mixed oxide fuel which they reuse in the current generation nuclear reactors.

If we were to reprocess, is that a practical use of the plutonium in the current reactors in the United States?

Dr. WEINBERG. Well, the issue—and this has not been brought up yet, and I didn't intend to go into it in particular—the real issue is economic.

As long as you have lots of uranium ore, then you have a difficult choice, do you reprocess it or not, depending on how much it costs to reprocess.

I think the general estimate that most people will give now is that the cost of reprocessing has gone up so high, so much, in the United States, that it is not economical to reprocess; it's better to dig up more uranium and go through the diffusion plants.

Senator Evans. Does that take into account the excess cost or the extra cost and volume of the waste that we ultimately must store?

Dr. WEINBERG. Well, since we don't really know how much the waste disposal is going to cost, I can't give a totally good answer to that.

But we do have a limit, namely, what is it, one mil per kilowatt hour, than the NWPA assesses the nuclear enterprise. And so that does roughly take that into account.

So it is an economic question. And although it may be advantageous, and I think it is advantageous in many ways to go the reprocessing route, you're not going to reprocess until it becomes economical.

Senator EVANS. Maybe all we have to do is mail it to the French and have them mail it back.

Dr. WEINBERG. Well, they will charge us—well, you see, the British and the Japanese get their stuff done at the French. And believe you me, the French charge a pretty penny for their reprocessing.

I think it's about $1,500 per kilogram, if I'm not mistaken.

Senator EVANS. There's always a fear on reprocessing of the plutonium that is generated. I think I'm accurate in saying that—and when we asked the French about that, the potential weapons use, they said it was possible to, in essence, dirty the plutonium with uranium, and in doing so, make it ineffective, essentially ineffective, for weapons use.

Is that an accurate statement?

Dr. WEINBERG. That's more or less accurate. I guess—let me only say that since 1943, when I first got started in this business, we had always realized that nuclear energy was just sort of a small flash in the pan unless you reprocessed and eventually went to the breeder.

The question is,when do you have to do that? And so all of us in the nuclear community, especially oldtimers, were totally dismayed when people said, well, let's put these spent fuel elements into the ground and forget about them.

And then we would ask the question, well, does that mean you have given up on the breeder? And we were assured, no, we haven't really given up on the breeder.

But my own sense about the matter is that many of the people who said, let's move in that direction, we're not opposed so much to reprocessing; they were opposed to the breeder, and therefore, they were fundamentally opposed to nuclear energy.

Because eventually you cannot have nuclear energy without the breeder. That's really what is at stake in the long run.

Senator Evans. Finally, would you say—it seems to me then that there are several reasons, again, as Senator McClure has pointed out for an extended period of time in an MRS, just to make these fuels or these wastes potentially more available.

It's in either a decision that we have found a way to reprocess that is economically better than mining more uranium, or we have decided at some time in the future to go to a breeder reactor, or our designs prove that re-use of that so-called waste is beneficial in the current generation of reactors; or that the ultimate cost of a deep geologic repository is so reduced by reprocessing and the reduced volume of waste that is left that the MRS is a good interim step.

Doesn't the evidence sort of pile up on behalf of making a first down rather than the touchdown that we failed to make?

Dr. WEINBERG. Absolutely.

The CHAIRMAN. Senator Ford?

Senator FORD. Let me just try public reaction with you just a moment. And I think this is what Senator Johnston was alluding to, we're getting to the point where we want to make it so safe it's almost cost prohibitive.

Referring to Congress, Dr. Weinberg, I'm sure you understand that this is a political house. And we listen, hopefully, most of the time to our constituents, and there are times when we have to take the bit in our teeth and go on with the judgment that is being presented by my colleagues here this morning.

What's wrong with the 80 individual sites or so to have the storage—you said you've changed your mind now from that original position to an MRS—what's wrong with the individual sites around the country near the generation facilities?

Because if you're going to 40, 50 or 100 years, those sites that are looking forward to keep it for 10 years are now going to look at it for 50 years, and the fear is not just going to be short-lived, it's going to be a long time for many generations, fathers, grandfathers, and so forth.

Dr. **Weinberg**. Well, as I say, the underlying assumption that you make in any of this waste disposal or waste storage above ground is somehow an imputation of partial immortality.

I can easily imagine, say, let's take that Swedish CLAB facility, the MRS there, which I visited a few years ago. A marvelous facility, beautiful. And you can well imagine that that will still be operating under the Swedish government 100, 200, 300 years from now.

It's a little bit less easy to imagine that every one of those 80 sites will be that long-lived. But it's not inconceivable.

One would certainly have to make lots and lots of provisions for ensuring this imputation of immortality.

Beyond that it becomes then to some degree an economic, not a technical matter. Which is cheaper, which is more convenient, which is likely to operate better?

If I judge the operation of reactors, I hate to admit this but not every reactor operator in the United States is as good as the best operator, and if you had 80 sites, I don't know, the NRC would probably rate these sites. And ten are the best sites, and ten are the poorest sites. And the poorest sites would get you into lots of argument.

But these are qualitative matters, and I don't want to say that it's a completely open and shut case; of course not.

Senator **Ford**. How many sites do the French have?

Dr. **Weinberg**. The French now have about 50 reactors. And they very wisely adopted a siting policy which I have recommended for about 20 years, namely, put as many reactors as possible on a single site.

And so I think they have an average of 2½ to 3 reactors on each site. So I would guess the French probably have about 15 sites now.

Senator **Ford**. Fifteen sites?

Dr. **Weinberg**. Something like that.

Senator **Ford**. A multiple number is not unusual?

Dr. **Weinberg**. In fact, most of the nuclear energy outside the United States is on sites that have four or more reactors. And it's just a terrible mistake that we made in our country where there are 25 utilities now that operate or will operate a single reactor on a single site.

Senator Ford: Now, Doctor, how many storage sites do the French have?

Dr. **Weinberg**. That I don't really know. I think Ben Rusche would be able to——

Senator Ford: Could we have Ben Rusche next?

Dr. **Weinberg**. Well, I think they have on-site storage at each one of these sites. But if you're talking about the equivalent of our MRS, I think they only have one site at their reprocessing plant at La Hague.

Senator Ford: So that's the reprocessing plant, and the rest of them are just small sites that——

Dr. **Weinberg**. They're reactor sites that I'm talking about.

Senator **Ford**. Reactor sites?

Dr. **Weinberg**. Yes, and they do have small on-site storage at those reactor sites, but then they ship their fuel to La Hague, which is the reprocessing site, and there they have what we would call an MRS.

Senator **Ford**. How soon do you have to start reprocessing spent fuel?

Dr. **Weinberg**. Well, I don't think you have to start reprocessing—I don't really know how long they are keeping their fuel.

Senator **Ford**. Do you have to start reprocessing in a minimum of three years?

What I'm trying to get is to try to work out something that is acceptable to the general public. The MRS is going to take a lot of transportation. We're going to see a lot of fear.

It's like trying to get nerve gas out of these various storage places, and get them to one place where they might be destroyed. Nobody wants them.

So they're passing ordinances. A train can't even bring it through a city, you know. And so we have this reaction.

And what I'm thinking about here is, if we had these on-site storage areas, and then convinced the public over a period of time it has cooled and it will make it easier to handle, I just wonder if it would make our position and our work here somewhat easier.

I don't know. I'm fishing here for an answer. And if my fishing here is typical of the real fishing, it's not too good. But I cast at a bass yesterday afternoon, and it just nudged my plug out of the way and went on. I don't understand it. I guess they were spawning.

But I hope you understand. I'm trying to find a way where we can make the judgment. And if it's within three years, that's within the 10-year period.

And I can just see these potential MRSs saying, well, we had it for 10 years and then it's gone; and now we're talking about 40, 50 or 100 years.

But I understand what you're trying to say is, that you'd store them, they would cool, make them easier to handle and probably gain more confidence.

I think the relationship between storage and generation doesn't make any difference. They both in the general public are associated almost together as of today.

And I think the story on TVA in the morning paper was quite damaging to the whole program as such, where more than 50 percent of those tested tested positive as it related to drugs.

And if those are the kinds of people operating our facilities, we're in trouble.

Thank you, Mr. Chairman.

The **Chairman**. Senator Murkowski?

Senator **Murkowski**. Thank you, Mr. Chairman.

I'm just going to make one brief comment. In reviewing the testimony of Dr. Weinberg, I noted your reference on two or three occasions to how we go about educating the public on storage, and reprocessing, and various other things.

And I'm wondering, this is a situation that continues to frustrate all of us, as we reflect on how to communicate a concern that is out there with the media, with those that have followed nuclear research, with the reality that it isn't a case of either/or, we have nuclear waste, it has to be disposed of appropriately.

There are technological advancements being made in reprocessing. Is there any way that conceivably a knowledgeable scientific group could speak with a degree of unanimity to ease the concern of the public and those that really don't have an opportunity to reflect on the merits of what is attempting to be achieved here as we try and address the dilemma we have?

Nobody seems to be responsive to any expertise. And I know that it's very difficult to find a group of scientists that would stand up and say, we should reprocess, or we should adopt in the area of storage a procedure.

And you as a professional in this area have obviously felt frustrated by this as well.

How do you suggest we get from here to there?

Dr. **Weinberg**. I've had occasion to worry very seriously about this matter, not so much in connection with the radioactive waste, but in the even deeper problem of the acceptability of nuclear reactors themselves.

And the suggestion that I finally come to, somewhat reluctantly, but it's almost my final fling in this business—I'm not as young as I used to be, as you know—goes like this, that I don't think we're going to build another nuclear reactor for 20 years in this country, quite likely.

Could we not move in nuclear reactor design away from reactors whose safety is determined probabilistically; namely, by figuring out that there's a small chance of this not working, a small chance of that not working, and so on, a procedure which the public is uncomfortable with, the public doesn't like probabilities, move to reactors that, as we call them, are inherently safe, that are transparently safe, where you don't have to make probabilistic estimates, but you see that, well, according to the simple laws of gravity, of thermodynamics, of engineering, the thing is obviously safe.

What I've then suggested is that perhaps once you agree that that's the direction that reactor design ought to go towards, then we ought to somehow assemble scientists who like nuclear energy, like Alvin Weinberg, if you like, and scientists who are very skeptical about nuclear energy, say the science adviser of the Audobon Society, or people from the Natural Resources Defense Council, and see whether they cannot get together and agree that they believe the thing is safe.

And I was quite impressed by the fact that Jan Beyea, who is the science adviser to the Audobon Society, I believe testified before this committee, shortly after Chernobyl, and said that we ought, as a response to Chernobyl, develop both solar energy and nuclear energy, and suggested a very large sum to be spent in developing solar energy and inherently safe nuclear energy.

And then he said he wasn't sure that solar energy would work, but it was quite likely that inherently safe reactors would work. And he then said, at that time—say the early 2000s—the environmental movement will once more accept nuclear energy.

And the thrust of my testimony is that perhaps one might be able to get something going in the waste disposal business along these lines.

I am enormously impressed that in Sweden, where the argument over nuclear energy was far more severe than it was in the United States, that it is no longer an issue, and the waste disposal is no longer an issue.

And I believe it is because they have come up with a package that they can understand. If the package doesn't leak, then there's no problem, and everybody accepts it, and that's it.

Now it may be that even such technical fixes, such as inherently safe waste packages, as well as inherently safe reactors, will still not allow us to accept nuclear energy. So be it. Then the United States will have to, in this generation, the next generation, turn away from nuclear energy.

But I do feel that there is enough possibility there, and enough precedent in the Swedish experience and what some of the environmental people are saying, so that perhaps we ought to try something of that sort.

Can't guarantee it, though.

Senator **Murkowski**. Thank you. I just wonder as you proceed with this matter, since most of the objections are based on fear, if there's some way to weave in the responsible environmental community into recognizing that they have an obligation to come up with some answers, as opposed to just the question of negating, if you will, the efforts that are attempting to be made to resolve what we have, and bring them into contributing something so that we can achieve the objective, and that's how we're going to handle nuclear wastes in this country.

The **Chairman**. Well, one of the ways we do it, we hope, is to bring in an expert like Dr. Weinberg. And I guess there's no expert like Dr. Weinberg; there is Dr. Weinberg.

Then to bring in the National Academy of Sciences, Nuclear Regulatory Commission, and have them tell us what the facts are.

And so that's what the morning's hearing is about. I'm not sure that every last vestige of doubt about waste disposal will be extirpated today, Doctor, but we hope we've gone a long way in that direction.

Thank you so much for your testimony.

Dr. **Weinberg**. Thanks very much.

The **Chairman**. Next we will hear from Mr. Hugh Thompson, Director of the Office of Nuclear Material Safety and Safeguards, of the U.S. Nuclear Regulatory Commission.

He is accompanied by Mr. Robert Browning, Director of the Division of Waste Management.

STATEMENT OF HUGH L. THOMPSON, JR. DIRECTOR, OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS, U.S. NUCLEAR REGULATORY COMMISSION, ACCOMPANIED BY ROBERT E. BROWNING, DIRECTOR, DIVISION OF HIGH LEVEL WASTE MANAGEMENT; AND RICHARD E. CUNNINGHAM, DIRECTOR, DIVISION OF FUEL CYCLE, MEDICAL, ACADEMIC, AND COMMERCIAL USE SAFETY

Mr. THOMPSON. Yes, to my left—good morning, sir—to my left is Mr. Richard E. Cunningham, who is the director of our Division of Fuel Cycle, Medical, Academic, and Commercial Use. He is responsible for the review of the MRS in my office.

I'd like to thank you this morning, Mr. Chairman, for the opportunity to provide the NRC staff views on several matters related to the Department of Energy's civilian high level radioactive waste program that are of interest to you and other members of the committee.

As requested in your letter of invitation, I will first discuss NRC staff comments on DOE's final environmental assessments.

The NRC comments on DOE's environmental assessments were also the subject of your letter of March 10th, 1987, to the Commission; and the Commission's April 13th, 1987 reply.

With your permission, Mr. Chairman, I would like to introduce these letters into the record.

The CHAIRMAN. Yes, without objection, those will be placed in the record.

Mr. THOMPSON. Thank you, sir.

[The letters follow:]

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

CHAIRMAN

April 13, 1987

The Honorable J. Bennett Johnston, Chairman
Committee on Energy and Natural Resources
United States Senate
Washington, D.C. 20510

Dear Mr. Chairman:

I am responding to your March 10, 1987 letter seeking clarification of the Nuclear Regulatory Commission (NRC) staff comments on the Department of Energy's (DOE) final environmental assessments (FEA's) of the potential repository sites.

The NRC staff review of the FEA's and the responses to specific questions which are enclosed are limited to the specific responsibilities of NRC: public health and safety and the waste isolation considerations found in 10 CFR Part 60, NRC regulations for "Disposal of High-Level Radioactive Waste in Geologic Repositories" and the associated DOE Siting Guidelines. In deciding whether to proceed with site characterization, the DOE has considered other factors outside NRC's regulatory responsibility (e.g., cost, schedule, ranking of sites). The NRC staff has not reviewed or commented upon such areas.

In this context, the NRC staff review of the five FEA's did not identify concerns that would call into question the suitability of any of the five sites for site characterization. While numerous concerns have been identified by NRC staff relative to each site, these concerns are of the nature anticipated at any site for which the existing data base is limited. While these concerns should not disqualify the sites from further testing to determine their suitability for the repository, they are significant with respect to the licensability of each site. The purpose of site characterization is to develop data to evaluate the validity and significance of such concerns relative to site suitability. Hence, these concerns need to be addressed as the DOE draws up Site Characterization Plans (SCP's) for each site.

Consequently, there is no reason, based on the NRC staff review of the FEA's and of other materials developed by the DOE and other parties, to delay characterization of the three sites selected by the DOE. The NRC concerns can only be addressed through the site characterization process.

These general statements are intended to clarify the NRC position on the FEA's and the state of the DOE HLW program. In your letter you asked the Commission to respond to twelve questions regarding the nature of the NRC staff comments and how they should be viewed by the DOE and the Committee. The enclosure to this letter contains the NRC responses to those questions. I hope that our specific answers, taken in conjunction with the contents of this letter, will provide the clarification of the NRC's position that you seek.

Commissioner Asselstine does not agree with this response.

Sincerely,

Lando W. Zech Jr.

Lando W. Zech, Jr.

Enclosure:
NRC responses to questions

cc: Senator Mark O. Hatfield

QUESTION 1. Have the states accurately characterized the nature and intent of the NRC staff comments?

ANSWER.

The states have focused on many of the same concerns that the NRC staff has raised relative to the FEA's. It is important to provide the context in which the NRC staff comments were presented. In a December 22, 1986 letter transmitting the FEA comments to DOE the staff concluded that "...in each of the final EA's our review identified remaining concerns which are principally related to 1) not identifying the range of uncertainties associated with the existing limited data base, 2) not identifying the range of alternative interpretations and assumptions that can be reasonably supported by existing data, and 3) not incorporating a reasonable range of uncertainties and alternative interpretations into evaluations and conclusions." The response also stated that "...recognition of these uncertainties and alternative interpretations is critical to the development of test plans that will lead to adequate characterization of sites and result in the information needed for licensing." None of the concerns would call into question the suitability of any of the five sites for site characterization. While numerous concerns have been identified to date relative to each site, these concerns are of the sort anticipated at any site when the existing data base is limited. While these concerns should not disqualify the sites from further testing to determine their suitability for the repository, they are significant with respect to the licensability of each site if they are not resolved through information gained from site characterization. Hence, these concerns need to be addressed as the DOE draws up an SCP for each site. The purpose of site characterization is to develop data to evaluate the validity and significance of such concerns relative to site suitability. Consequently, there is no reason, based on the NRC staff review of the FEA's, to delay characterization of the three sites selected by the DOE. The NRC staff concerns can only be addressed through the site characterization process.

QUESTION 2. How serious are the issues identified by the NRC?

ANSWER.

The concerns identified by the NRC staff do not question the adequacy of the sites for site characterization. They are significant with respect to the licensability of the sites if they are not resolved through information gained during site characterization. Hence these concerns need to be addressed as the DOE draws up an SCP for each site. The purpose of site characterization is to develop data to evaluate the validity and significance of such concerns relative to site suitability. Such concerns requiring evaluation through the site characterization process would be expected to exist with respect to any site under consideration for a repository.

QUESTION 3. Should the Committee be concerned that DOE is "recklessly" plowing ahead with flawed sites, as the states have charged?

ANSWER.

The DOE has evaluated each site against the Siting Guidelines which, in its concurrence, the Commission considered to address all key areas needing attention in the evaluation of site suitability. In its FEA's the DOE found no disqualifying factors for any of the five sites. The NRC staff's independent review likewise has not identified any disqualifving factors. However, the NRC staff did identify a number of factors, typical of any site with a limited data base, needing to be addressed during site characterization.

It is important to note that the NRC review of the FEA's was limited to the public health and safety and the waste isolation considerations found in 10 CFR Part 60. In deciding whether to proceed with site characterization, the DOE has considered other factors outside the NRC's regulatory responsibility (e.g., cost; schedule; ranking of sites). The NRC has not reviewed or commented upon such areas.

QUESTION 4. Do the NRC staff concerns indicate that DOE should select other sites for characterization or simply that DOE needs to collect more data to evaluate those sites?

ANSWER.

As explained previously, the NRC staff has not identified any reasons why the three sites selected should not be characterized. Staff concerns indicate that more data needs to be collected during site characterization in order to find out whether the concerns raised can be satisfactorily resolved. Such concerns exist for all nine of the sites that were identified by the DOE in February, 1983 as potentially acceptable sites for a mined geologic repository, and would be expected to exist for any potential site with a limited data base. NRC staff review of the nine draft Environmental Assessments (DEA's) found no disqualifying factors for any site but raised concerns similar to the ones raised relative to the five sites in the NRC staff review of the FEA's. Hence it should not be inferred that the concerns expressed by the NRC staff relative to the three sites selected for site characterization indicate that DOE should select other sites.

QUESTION 5. Based on the information available today, does NRC feel there is any reason not to go ahead with site characterization at the sites in Nevada, Washington, and Texas?

ANSWER.

The NRC review of the FEA's was based on the public health and safety and the waste isolation considerations found in 10 CFR Part 60. On those bases the staff identified no disqualifying factors for any of the sites and no reason why site characterization should not proceed. In deciding whether to proceed with site characterization, the DOE has considered other factors outside the NRC's regulatory responsibility (e.g., cost; schedule; ranking of sites). The NRC has not reviewed or commented upon such areas.

QUESTION 6. Evaluating DOE's performance to date, does it appear that DOE is heading in the right direction in its efforts to develop a data base that will be sufficient to support a repository license application?

ANSWER.

There has been a continuous overall improvement in the DOE program to develop an adequate data base, in particular as demonstrated by resolution in the final EA's of many of the NRC concerns identified relative to the draft EA's. The March 3-4, 1987 briefing of the NRC staff and the affected states and tribes by the DOE on their issues hierarchy and issue resolution strategy laid out a logical and rigorous way of identifying issues and the data needed to resolve them. How the DOE implements the issue resolution strategy is the key to whether they are heading in the right direction. NRC staff review of the SCP's will assess their progress in this area. One early indication that the DOE is progressing in this area is their recognition of the need to conduct key hydrologic testing at the Hanford site prior to construction of the exploratory shaft.

QUESTIONS 7-12. . Comment on the six technical areas cited by the State of Nevada.

ANSWER.

The State of Nevada has focused on many of the same concerns that the NRC has raised relative to the Yucca Mountain Site FEA. However, it is again important to provide the context in which the NRC staff comments were presented. No issues were identified during the NRC staff review of the Yucca Mountain Site FEA that call into question the suitability of the Yucca Mountain site for characterization. The concerns identified can be potentially disqualifying with respect to the licensability of the Yucca Mountain site if they are not resolved through information gained from site characterization. The purpose of site characterization is to develop data to evaluate the validity and significance of such concerns relative to site suitability. Hence, these concerns need to be addressed in the SCP for the Yucca Mountain site.

In response to the Committee's request to comment on the six technical areas cited by the State of Nevada, each area is addressed below.

QUESTION 7. Active fault movement and reactivation of prior faulting by nuclear nuclear weapons testing.

ANSWER.

As stated in NRC staff comment 1 on the Yucca Mountain Site FEA, available evidence suggests that faults in the vicinity of Yucca Mountain have undergone movement in the last 40,000 years and that some faults in that area have been reactivated by nuclear weapons testing. Fault activity can cause vibratory ground motion. During site characterization the DOE needs to ascertain which of the several different types of faults at and in the vicinity of Yucca Mountain are potentially active and whether the vibratory ground motion and/or movement associated with those faults could disrupt repository construction and operation and impact the waste isolation capabilities of the Yucca Mountain site.

QUESTION 8. Hydrothermal activity beneath Yucca Mountain which could affect the waste isolation capability of the site or any containers used there.

ANSWER.

As stated in NRC staff comment 4 on the Yucca Mountain Site FEA, the presence of calcite-silica vein deposits at several locations at and around Yucca Mountain suggests the potential for hydrothermal activity in the area. Such activity could open new pathways for groundwater and any released radionuclides to reach the accessible environment or could enable high-temperature corrosive fluids to come into contact with the waste package, possibly resulting in higher than expected rates of corrosion for the waste package. During site characterization the DOE needs to determine if the veins are of hydrothermal origin and if they are, whether that phenomenon could be a mechanism for radionuclide transport to the accessible environment or a process by which high-temperature corrosive fluids are introduced to the waste package environment.

QUESTION 9. The possibility of ore deposits in the area that might cause future human intrusion.

ANSWER.

As stated in NRC staff comment 5 on the Yucca Mountain Site FEA, the limited data base currently available permits as one interpretation that there may be significant economic natural resource potential in the Yucca Mountain area. Should that prove to be true, the possibility exists of economically motivated post-closure human-interference activities that could adversely affect the waste isolation capabilities of the Yucca Mountain site. During site characterization the DOE needs to assess the magnitude of the natural resource potential of the Yucca Mountain area and the significance of any associated potential for future human intrusion.

QUESTION 10. DOE's overreliance on the geochemical system to retard radionuclide transport through the rock.

ANSWER.

As stated in NRC comment 8 on the Yucca Mountain Site FEA, the DOE is relying on various radionuclide retardation mechanisms based on properties of the bulk rock and of certain minerals in the rock to substantially diminish radionuclide transport. However, evidence supporting the effectiveness of these mechanisms is currently not conclusive. If the effectiveness of these mechanisms cannot be demonstrated, credit cannot be taken for these features of the geochemical system at Yucca Mountain in the evaluation of the site's waste isolation capabilities. During site characterization the DOE needs to pursue field and laboratory methods to establish the effectiveness of these mechanisms to retard the transport of radionuclides.

QUESTION 11. DOE's overreliance on models of a groundwater travel time in the unsaturated zone.

ANSWER.

As stated in NRC staff comment 7 on the Yucca Mountain Site FEA, The existence of extensive fracturing within the rocks above the water table (i.e., in the unsaturated zone) at Yucca Mountain could contribute to significantly faster movement of groundwater to the accessible environment than is currently projected in the Yucca Mountain FEA hydrologic model which assumes that matrix flow is dominant. During site characterization the DOE needs to gain a better understanding of the nature and rates of flow in the Yucca Mountain hydrologic system.

QUESTION 12. DOE's overreliance on the uncertain performance of engineering barrier systems.

ANSWER.

In the Yucca Mountain Site FEA, DOE has suggested 3000 years as a conservative estimate for the waste package lifetime (See Answer to #9). Given the current uncertainties in the models and data used to extrapolate to a minimum 3000 year container life, the NRC staff cannot now characterize as either realistic or conservative. Consequently, during the development of their site characterization and testing plans, the DOE needs to recognize the uncertainties in their models and data. DOE should focus their efforts on gathering site and experimental data that decrease the amount of uncertainty in their estimate of waste package lifetime and develop a realistic and defensible value.

J. BENNETT JOHNSTON, LOUISIANA, CHAIRMAN

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United States Senate

COMMITTEE ON
ENERGY AND NATURAL RESOURCES
WASHINGTON, DC 20510

March 10, 1987

The Honorable Lando W. Zech, Jr.
Chairman
U.S. Nuclear Regulatory Commission
1717 H Street, N.W.
Washington, D.C. 20555

Dear Mr. Chairman:

In order to evaluate the state of the Department of Energy's nuclear waste program, the Committee on Energy and Natural Resources has received testimony from the Department and representatives of affected states and Indian tribes. During the course of that testimony, several of the state representatives cited criticisms made by the NRC staff of the Department's final environmental assessments of the potential repository sites. According to the states, these NRC staff comments, submitted to the Department on December 22, 1986, raised questions about the adequacy of each of the three sites selected by DOE for detailed site characterization.

The state representatives cite NRC's conclusion that DOE has been overly confident in its technical assumptions. Representatives of the state of Nevada have also cited NRC staff conclusions that "DOE has repeatedly interpreted its data in a manner consistent with accomplishing its siting goals," and the state has implied that DOE is compromising safety in its decisionmaking. Nevada officials also identified six specific technical areas where they say DOE's reasoning has been defective.

According to my reading of the NRC staff comments, it appears that the states may have overstated NRC's case. NRC found that some of DOE's conclusions were overly favorable or optimistic. NRC also cautioned that more data is needed to properly interpret and evaluate uncertainties. But, as I understand it, the NRC staff did not conclude that any of the sites should be found unsuitable at this point, nor that DOE should not go ahead with site characterization.

It would be helpful if you could clarify for the Committee the precise nature of the NRC staff comments and interpret for us how the comments should be used by both DOE and the Committee. Specifically, the answers to the following questions would be helpful.

--Have the states accurately characterized the nature and intent of the NRC staff comments?

--How serious are the issues identified by NRC?

--Should the Committee be concerned that DOE is "recklessly" plowing ahead with flawed sites, as the states have charged?

--Do the NRC staff concerns indicate that DOE should select other sites for characterization or simply that DOE needs to collect more data to evaluate these sites?

--Based on the information available today, does NRC feel there is any reason not to go ahead with site characterization at the sites in Nevada, Washington, and Texas?

--Evaluating DOE's performance to date, does it appear that DOE is heading in the right direction in its efforts to develop a data base that will be sufficient to support a repository license application?

It would also be helpful if you could comment on the six technical areas cited by the state of Nevada. These issues, including in Nevada's testimony to the Committee, are the following:

--Active fault movement and reactivation of prior faulting by nuclear weapons testing.

--Hydrothermal activity beneath Yucca Mountain which could affect the waste isolation capability of the site or any containers used there.

--The possibility of ore deposits in the area that might cause future human intrusion.

--DOE's overreliance on the geochemical system to retard radionuclide transport through the rock.

--DOE's overreliance on models of groundwater travel time in the unsaturated zone.

--DOE's overreliance on the uncertain performance of engineering barrier systems.

Please comment both on the seriousness of these concerns and on whether enough data is available today to evaluate these issues.

I would appreciate your prompt attention to these issues.

Sincerely,

J Bennett Johnston

J. Bennett Johnston
Chairman

Mr. THOMPSON. I would also, then, like to identify some potential technical and policy issues which the staff is considering in preparing an analysis of Senate bill 839, the Nuclear Waste Policy Act Amendments of 1987 for consideration by the Commissioners.

The staff comments on DOE's 5 final environmental assessments for potential repository sites were forwarded to DOE in our letter of December 22nd, 1986.

As noted in our forwarding letter, the NRC staff comments are part of the prelicensing consultation between the staffs of DOE and the NRC.

This prelicensing consultation is intended to ensure early identification and resolution of potential licensing issues.

The intent of our comments on the environmental assessments was to assist the DOE in preparing high quality site characterization plans for each site. It was not our intent that the final environmental assessments be modified, or that the progress of the site investigation program be halted.

The NRC staff's review of the environmental assessments was limited to the specific responsibilities of the NRC: public health and safety; and the waste isolation considerations found in 10 CFR part 60, NRC regulations, for disposal of high level radioactive waste in geologic repositories; and related considerations in the DOE siting guidelines.

In deciding whether to proceed with site characterization at each of the selected sites, DOE considered other factors outside of NRC's regulatory responsibilities, such as cost and schedules, and the overall ranking of sites.

Our December 22nd, 1986 letter to DOE noted that DOE had made significant efforts to respond to each of NRC staff's major comments on the draft environmental assessments, and had resolved many of these comments.

However, in each of the final environmental assessments, the staff's review identified some remaining concerns. These remaining concerns involved cases in which DOE had not, one, identified the range of uncertainties associated with the limited existing data base; two, identified the range of alternative interpretations and assumptions that can reasonably be supported by the existing data; or, three, incorporated a reasonable range of uncertainties in alternative interpretations into evaluations and conclusions.

At this stage of the site investigation and screening process, there is inherent uncertainty in site information that can lead to alternative interpretations of data.

Furthermore, resolution of uncertainties such as those identified in our comments can only be addressed to the site characterization process.

Recognition of these uncertainties and alternative interpretations is critical to the develop of site characterization plans that will lead to adequate characterization of sites, and result in information needed for licensing.

If I may just abbreviate some of my comments to speed things up today, I will submit for the record my full comments and just go on and identify some of the other points.

Our December 22, 1986 letter also noted that improvements in the NRC and DOE technical staff interactions was necessary to ensure that NRC staff concerns are being addressed in development of DOE's site characterization plans.

We suggested that two important issues be scheduled for discussions at technical meetings as soon as practicable. I am pleased to report that a meeting on one of these issues was held during the week of April 5th at Hanford, Washington.

The subject was hydrologic testing that should be performed before sinking the exploratory shaft at the Hanford site. The meeting included state and Indian tribe representatives as active participants.

The manner in which DOE conducted this meeting, both in its thorough treatment of the technical issues, and its achievement of an effective dialogue with the interested parties, is an example of the improvement we believe is needed to reach consensus on such difficult technical issues.

On the basis of the information presented by DOE and discussed at the meeting, NRC staff accepted DOE's proposed approach as a logical step.

NRC management is committed to continuing efforts to improve the effectiveness of these technical meetings, including efforts to assure active participation by states and Indian tribes.

I should stress that the NRC staff comments on the final environmental assessments focused only on those concerns that we believe had not been sufficiently addressed to date in the final environmental assessments.

Our comments were not intended to be a catalogue of all our concerns at each site, nor were they intended to limit our ability to address additional concerns that may arise.

If we did not mention a concern in our final environmental assessment, it was because we believed that DOE had adequately recognized it in their final environmental assessment, and the need to resolve that concern; not because we believed that concern had been resolved, and was no longer a potential issue for licensing.

With your permission now, I would like to identify some of the staff's preliminary issues based on our early review of Senate bill 839.

As you know, NRC's fundamental goal is to ensure that any repository site will be chosen on the basis of its ability to isolate waste according to NRC's technical criteria, and that sufficient information will be available to make such judgments.

The NRC staff believes it important that the process of selecting a site, one, provide opportunity for early identification and resolution of potential licensing issues; two, provide for detailed site characterization at a sufficient number of sites to afford reasonable assurance that at least one of the sites can be licensed on a schedule in keeping with the Nuclear Waste Policy Act objectives; three, ensure the quality and sufficiency of the safety related information needed for licensing; and four, provide an opportunity for active participation of concerned parties with NRC to allow for timely identification and resolution of potential licensing issues.

The staff is generally concerned that because the bill does not make clear which sections of existing laws are to be affected, or how they would be affected, these considerations may not receive adequate attention.

Further, consideration may be warranted on such matters as participation rights of states and Indian tribes, and Congress' role in approving or disapproving a repository.

One potential issue is whether states and Indian tribes could, as a practical matter, continue to participate with NRC in identifying potential licensing issues throughout the process without risk of being found in default of the incentive agreement.

In addition to the general concerns about the bill's impact on existing law, the staff has identified several more potential issues which warrant further consideration.

One of our principal concerns is that, considering the first of a kind nature of this effort, selection of only one site for a detailed site characterization runs the risk of resulting in a site which may ultimately prove unlicensable.

If, after suspending characterization of other sites, DOE were to find its initially chosen site inadequate, or if it could not provide assurance in a licensing proceeding that a site met NRC requirements, there could be considerable delay while characterization was completed on another site or slate of sites, with a consequent loss of momentum.

The impact of such a delay on NRC's stated belief that there is reasonable assurance that methods of safe, permanent disposal of high level waste would be available when they are needed would have to be carefully evaluated.

We believe that a sufficient number of sites will have to be characterized in detail at repository depth to provide reasonable assurance that at least one will be suitable for licensing on a tight schedule, such as that set forth in the Act.

Another potential issue is the adequacy of the technical information to be acquired by DOE to support its selection of a site for detailed site characterization.

With respect to any new site other than those for which DOE has completed a final environmental assessment, the staff is concerned that 12 months may not be enough time to investigate the site sufficiently to allow a determination of suitability for characterization.

We also believe that such a determination should be preceded by the development of information at least equivalent to that provided in the final environmental assessments by DOE, and an opportunity for NRC and other interested parties to comment on any such site.

We believe further consideration is warranted to ensure that greater emphasis is placed on identifying and resolving health and safety issues on schedule.

In conclusion, Mr. Chairman, I'd like to summarize the NRC staff views on the issues before the committee in this hearing.

First, based on our review of the DOE final environmental assessments, we believe there is no technical reason why site characterization should not continue.

The high level waste repository is a first of a kind facility involving complex, unique technical issues, which can only be resolved through a detailed site characterization program.

Second, the staff is currently reviewing Senate bill 839 in order to provide an analysis to the Commission in their consideration of policy issues and technical issues which may affect the NRC regulatory responsibilities.

Based on preliminary staff view we believe that the bill, as drafted, may result in premature selection of one site, with a possibility of delays in repository development.

We'd be pleased to answer any questions you may have on our testimony.

[The prepared statement of Mr. Thompson follows:]

PREPARED TESTIMONY
SUBMITTED BY THE
UNITED STATES NUCLEAR REGULATORY COMMISSION

TO THE
COMMITTEE ON ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE

CONCERNING
TECHNICAL ISSUES IN THE DEPARTMENT OF ENERGY'S
CIVILIAN NUCLEAR WASTE PROGRAM

PRESENTED BY
HUGH L. THOMPSON, JR., DIRECTOR
OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS

SUBMITTED: APRIL 28, 1987

I would like to thank you, Mr. Chairman, for this opportunity to provide the Nuclear Regulatory Commission (NRC) staff views on several matters related to the Department of Energy's (DOE's) civilian high-level radioactive waste program that are of interest to you and other members of the Committee. As requested in your letter of invitation, I will first discuss the NRC staff comments on DOE's final Environmental Assessments (EA's). The NRC's comments on DOE's EA's were also the subject of your March 10, 1987 letter to the Commission and the Commission's April 13, 1987 reply. With your permission, Mr. Chairman, I would like to introduce these letters into the record. I would then like to identify some potential technical and policy issues which the staff is considering in preparing an analysis of Senate Bill 839, the "Nuclear Waste Policy Act Amendments of 1987," for consideration by the Commission.

NRC Staff Comments on DOE's Final Environmental Assessments

NRC staff comments on DOE's five final Environmental Assessments (EA's) for potential repository sites were forwarded to DOE in our letter of December 22, 1986. As noted in the NRC forwarding letter, the NRC staff comments are part of the pre-licensing consultation between the staffs of the DOE and NRC. This pre-licensing consultation is intended to ensure early identification and resolution of potential licensing issues. The intent of our comments on the EA's was to assist the DOE in preparing high-quality Site Characterization Plans (SCP's) for each site. It was not our intent that the final EA's be modified or that the progress of the site investigation program be halted.

The NRC staff review of the EA's was limited to the specific responsibilities of NRC: public health and safety and the waste isolation considerations found in 10 CFR Part 60, NRC regulations for "Disposal of High-Level Radioactive Waste in Geologic Repositories" and related considerations in the DOE Siting Guidelines. In deciding whether to proceed with site characterization at each of the selected sites, DOE has considered other factors outside NRC's regulatory responsibility, such as cost and schedule, and the overall ranking of sites.

Our December 22, 1986 letter to DOE noted that DOE had made significant efforts to respond to each of the NRC staff's major comments on the draft EA's, and had resolved many of these comments. However, in each of the final EA's, the staff review identified some remaining concerns. These remaining concerns involved cases in which DOE had not: (1) identified the range of uncertainties associated with the limited existing data base; (2) identified the range of alternative interpretations and assumptions that can be reasonably supported by existing data; or (3) incorporated a reasonable range of uncertainties and alternative interpretations into evaluations and conclusions.

At this stage of the site investigation and screening process, there is inherent uncertainty in site information that can lead to alternative interpretations of data. Furthermore, resolution of uncertainties -- such as those identified in our comments -- can only be addressed through the site characterization process. Recognition of these uncertainties and alternative interpretations is critical to the development of SCP's that will lead to adequate characterization of sites and result in the information needed for licensing. To the extent necessary for demonstrating compliance with NRC regulations, site characterization testing should lead to narrowing the range of uncertainties, eliminating alternative interpretations and confirming or revising assumptions on the basis of new data and analyses. This narrowing process will not be effective unless test plans recognize the range of uncertainties and alternative interpretations and assumptions that can be reasonably supported by the existing data.

Our December 22, 1986 letter noted that improvement in the NRC and DOE staff technical interactions was necessary to ensure that NRC staff concerns are being addressed in the development of DOE's site characterization plans. We suggested that two important issues be scheduled for discussion at technical meetings as soon as practicable. I am pleased to report that a meeting on one of these issues was held during the week of April 5 at Hanford, Washington. The subject was hydrologic testing that should be performed before sinking the exploratory shaft at the Hanford site. The meeting included State and Indian tribe representatives as active participants. The manner in which DOE conducted this meeting, both in its thorough treatment of the technical issues and its achievement of an effective dialogue with interested parties, is an example of the improvement we believe is needed to reach consensus on such difficult technical issues. On the basis of the information presented by DOE and discussed at the meeting, NRC staff accepted DOE's proposed approach as a logical step. NRC management is committed to continue efforts to improve the effectiveness of these technical meetings, including efforts to assure active participation by States and Indian tribes.

I should stress that the NRC staff's comments on the final EA's focused only on those concerns that we believed had not been sufficiently addressed to date in the final EA's. Our comments were not intended to be a catalogue of all our concerns at each site, nor were they intended to limit our ability to address additional concerns as they arise. If we did not mention a concern in our final EA comments, it was because we believed that DOE had adequately recognized in its final EA's the need to resolve that concern, not because we believed that the concern had been resolved and was no longer a potential issue for licensing.

S. 839: "The Nuclear Waste Policy Act Amendments of 1987"

The staff is currently reviewing S.839 in order to provide for the Commission's consideration an analysis of technical and policy issues which may potentially affect NRC regulatory responsibilities. I would like to take this opportunity to present NRC staff views on several of the major considerations raised in our review of S.839.

We recognize that a major policy issued raised in S.839 is the approach of offering a State or Indian tribe a financial incentive to host a repository or Monitored Retrievable Storage Facility (MRS). I would only note that the incentive approach is not unique. For example, both France and Japan have used incentive programs for nuclear power stations, and these programs appear to be successful. The NRC staff's analysis of the bill has focused, however, on potential impacts on NRC's health, safety, and environmental responsibilities, and our licensing process. I will confine the balance of my remarks to these areas of responsibility.

NRC's fundamental goal is to ensure that any repository site will be chosen on the basis of its ability to isolate waste according to NRC's technical criteria, and that sufficient information will be available to make such judgements. The NRC staff believes it is important that the process of selecting a site: 1) provide opportunity for early identification and resolution of potential licensing issues; 2) provide for detailed site characterization at a sufficient number of sites to afford reasonable assurance that at least one of the sites can be licensed on a schedule in keeping with NWPA objectives; 3) ensure the quality and sufficiency of safety-related information needed for licensing; and 4) provide opportunity for active participation of concerned parties with NRC to allow for timely identification and resolution of potential licensing issues.

The staff is generally concerned that because the bill does not make clear which sections of existing law are to be affected, or how they would be affected, these considerations may not receive adequate attention. Further consideration may be warranted on such matters as participation rights of States and Indian tribes and Congress' role in approving or disapproving a repository. One potential issue is whether States and Indian tribes could, as a practical matter, continue to participate with NRC in identifying potential licensing issues throughout the process, without risk of being found in default of the incentive agreement. Read in conjunction with the

Secretary's prerogative under Section 406(A) to terminate an agreement as a result of conduct by the States and Indian tribes, for example, Section 402(B)(1) appears to call into question a State's or Indian tribe's right to raise these issues without suffering a loss of incentive funds.

In addition to the general concern about the bill's impact on existing law, the staff has identified several more potential issues which warrant further consideration. One of our principal concerns is that, considering the first-of-a-kind nature of this effort, selection of only one site for detailed site characterization runs a risk of resulting in a site which may ultimately prove unlicenseable. If, after suspending characterization of other sites, DOE were to find its initially-chosen site inadequate, or if it could not provide assurance in a licensing proceeding that the site met NRC technical requirements, there could be considerable delay while characterization was completed on another site or slate of sites, with a consequent loss of momentum. The impacts of such a delay on NRC's stated belief that there is reasonable assurance that methods of safe permanent disposal of high level waste would be available when they are needed, would have to be carefully evaluated.

We believe that a sufficient number of sites will have to be characterized in detail at repository depth, to provide reasonable assurance that at least one will be suitable for licensing, on a tight schedule such as that set forth in the Act. As the Commission noted in the Statement of

Considerations accompanying publication of NRC's proposed licensing procedures, this position follows from consideration of both the long-term performance required of and the technical uncertainties involved in the geologic disposal of HLW. (44 FR 70409, Dec. 6, 1979)

Another potential issue is the adequacy of the technical information to be acquired by DOE to support its selection of a site for detailed site characterization. With respect to any new site (other than those for which DOE has done final Environmental Assessments), the staff is concerned that 12 months may not be enough time to investigate the site sufficiently to allow a determination of suitability for characterization. We also believe that such a determination should be preceded by the development of information at least equivalent to that provided in the final EA's and by an opportunity for NRC and other interested parties to comment on any such site. We believe further consideration is warranted to ensure that greater emphasis is placed on identifying and resolving health and safety issues than on the schedule.

Summary

In conclusion, let me summarize the NRC staff's views on the issues before the Committee in this hearing. First, based on our review of the DOE final Environmental Assessments, we believe there is no technical reason why site characterization should not continue. The high-level waste repository is a first-of-a-kind facility, involving complex, unique technical issues which can only be resolved through a detailed site characterization program.

Second, the staff is currently reviewing S.839 in order to provide an analysis to the Commission in their consideration of policy issues which may affect NRC regulatory responsibilities. Based on preliminary staff review, we believe that the bill as drafted may result in premature selection of one site with a possibility of delays in repository development.

The **Chairman**. Yes, thank you very much, Mr. Thompson.

Mr. Thompson, some state representatives and others testifying at our previous hearings have stated that NRC comments on the Department's work so far suggests that sites selected at Hanford, Yucca Mountain and in Texas should be disqualified.

Now your statement, as I understand it, very clearly states that there is no reason why we should not proceed to characterize the three sites?

Mr. **Thompson**. That is correct. We have identified issues. We have identified a range of concerns of licensing issues which we believe in fact can only be resolved by proceeding with site characterization.

We see no technical reason that would disqualify any of these sites, based on the information that we have to date.

The **Chairman**. So that, in effect, from a technical standpoint, the Department of Energy's work on the three sites has been adequate and has been technically sufficient to proceed with the process?

Mr. **Thompson**. That's correct. Of course the site characterization plan is a key element in their proceeding, and we're working to have our technical dialogue on the development of these site characterization plans, which would ensure, to the degree that we can, that the information developed by these plans will adequately address the licensing and technical issues.

The **Chairman**. By the way, Mr. Thompson, can you say anything about this cost differential between—you were here when Dr. Weinberg testified. Why does it take us so much money?

Mr. **Thompson**. I would like to note—as I stated in my comments—that we did not look at cost as part of our concern. And I think probably one Federal agency specifically reviewing another Federal agency's detailed cost evaluation may be a little risky.

But I have not looked at that. We do understand that some of the cost aspects are under review, and they are important ones, but we have not reviewed that in any detail.

The **Chairman**. Well, let me emphasize that in dwelling on this question of cost today, I don't want any suggestion that I would want to compromise, or that any member of this committee, would want to compromise safety for cost.

But I was satisfied that the French and Swedes are very safe, so safe as to reassure those people in whose communities the facilities are placed, and yet they do it at a fraction of the cost we do.

I wish you could give some thought as to how, consistent with the NRC's very high standards of safety, we might also give some due regard to the poor taxpayer who is putting up these costs.

Mr. Browning, could you speak to that?

Mr. **Browning**. Mr. Chairman, I might suggest that when you ask that question of DOE, that we try to make sure that the factors that were included in the foreign cost estimates versus the $1 billion United States estimate actually include all the same factors.

We believe that it may be that there are other factors included in the $1 billion estimate that are not included in the foreign estimates.

That doesn't necessarily mean it still won't end up being higher, but I think the comparison between $1 billion and tens of millions may very well be misleading.

The CHAIRMAN. Well, certainly, the French doing their $10 million site characterization does not propose to be the full shaft and the laboratory.

The full shaft and the laboratory, I think, is $70 million. But that's a long way from a billion dollars. And when we say the 3-1/2 kilometers of tunnels at Forsmark for $100 million, I mean, it certainly gave us cause to think that maybe we're spending too much.

Now, the French are choosing one site for full characterization, with the laboratory at the bottom, and having what they call characterization, but it's certainly a more limited type for $10 million apiece at four other sites.

We asked them about what their degree of assurance was that the first site would become geologically acceptable. And they said, a very high degree. As I recall the percentage that they used, it was like 99 percent sure, between 99 and 100 percent sure.

Now, do you think the French are wrong in that? Or let me ask the question another way: Do you think that we might pick our best site in this country and be confident between 99 and 100 percent that that site would pass muster with the NRC licensing procedure?

Mr. THOMPSON. I would like to respond and ask Mr. Browning to maybe expand my comments.

I think it's difficulty for us, as the licensing agency, to make that judgment based on the sites that we've seen today. I think in each of the sites we have seen, there are legitimate technical issues which, if not resolved adequately, would prevent a site from being licensed.

The percentage and degree of confidence, maybe Mr. Browning would have a view on, but I certainly don't have one at this time, and I don't think we've made an effort to make such a probabilistic estimate as part of our effort today.

The CHAIRMAN. If we may, before I hear from Mr. Browning, let me put this in context.

If we can characterize one site instead of three, we save at least $2 billion. Now $2 billion is a lot of money in anybody's ballgame.

Now if we can do that without compromising safety, and without—and have the critical path for waste management such that if you do the one percent or whatever that probability is comes about, that you can then go to an alternative site and not have your nuclear waste without a home, in other words, if you could go then to a second one without hurting your schedule, we ought to do that, because $2 billion is, as I say, serious money.

Would you comment on that, Mr. Browning?

Mr. BROWNING. We really have no basis for assessing the confidence that the French say they have about their particular siting. Because we haven't—at least I personally haven't had the opportunity to talk directly with the French.

However, the Department of Energy made a similar kind of prediction on the three sites that they've recommended and are proposing to characterize. And the NRC staff did take issue with that level of confidence at this stage of the investigation of the sites on a site specific basis.

We've already taken issue with the confidence that the Department of Energy has that the three sites that they've selected for characterization will all survive the characterization process and ultimately be licensable.

So I would suspect, without any basis in fact, that we would have the same kind of observation based on the French developers—I assume it was the developer that was making that statement as opposed to the regulatory agency.

The CHAIRMAN. It wasn't a developer in the sense of a private developer. It was the CEA, the French nuclear company, Energy de France, or whatever it is.

But in any event, they don't have quite the relationship between their regulatory agency that we do in this country. Ours of course is more adversary; theirs is more cooperative.

But in any event, you disagree with that degree of confidence. Would you care to put a number on the degree of confidence?

Mr. BROWNING. No, sir. At this stage we can't.

The CHAIRMAN. Well——

Mr. THOMPSON. I don't think we've really looked——

The CHAIRMAN. Is three sites enough to characterize, in your view?

Mr. BROWNING. Yes, sir, that's consistent with our regulation and consistent with the current law.

The CHAIRMAN. Well, it certainly is consistent with the law, but I mean the science doesn't bend to suit the law, the law bends to suit the science.

Did we pick the proper number in the law when we picked three, or should it be two or should it be five or should it be one?

Mr. BROWNING. In a way, we're prejudiced because our rule does include three. And at the time we processed the rule, we thought three was a sufficient number.

Mr. THOMPSON. Mr. Chairman, I might add, that that was geared to the schedule in the law, and having the confidence that that could not be done sequentially, but obviously, we're going to make our licensing decision on the best technical judgment that we can provide.

To the extent that schedule is important, and it was in the law, then we felt that the selection of three sites was an appropriate approach.

Obviously, if the aspect of schedule has less importance, then we will review the sites and make our judgment based on that. And we can do that sequentially as far as process goes, and it will not jeopardize our technical review, but it would have the aspect that the Commission would revisit, as we have committed to, our waste confidence proceeding finding which we will look at about every five years or so.

The CHAIRMAN. I think the key point of our testimony, of course, is that after review of the process so far, there's no reason at all to stop the process and start over again; that we should proceed; we can proceed safely with the Act, with the characterization of the sites?

Mr. THOMPSON. Yes, sir.

The CHAIRMAN. Senator McClure.

Senator MCCLURE. Thank you very much, Mr. Chairman.

A rather general question about what DOE is doing, as you see it. Aside from the questions that you have raised—and I notice you say that even though we haven't raised them the second time, that doesn't mean we don't still have them. Is that correct?

Mr. THOMPSON. That's correct. I think that DOE had adequately characterized and identified a technical issue for further site characterization that would be pursued, and we felt that their program did an adequate job of identifying that.

Senator MCCLURE. You might well have the same questions, and you would have raised them had they not already raised the issue?

Mr. THOMPSON. I think that's an accurate way to say that.

Senator MCCLURE. Do you feel that the DOE activities planned for under site characterization represent overkill, or are they reasonable in terms of the information required to adequately substantiate the site suitability?

You've indicated that they're enough. Are they too much?

Mr. THOMPSON. I will give an initial answer, and I'd like Mr. Browning to add in, if you'd like.

Generally, we are still working with the level of detail on site characterizations. There have been times where we have met on technical issues such as the hydrologic questions at the Hanford site, and we believe they are addressing that adequately.

The specifics on the site characterization plans, and their proposal on those, have not been submitted to us. But in general we believe that they are addressing, or after our discussions, will adequately address the issues, so that they will, I guess, better define the level of uncertainty associated with those issues, as well as integrate into the system, that is, the waste disposal system, a sufficient basis for us to make a licensing decision.

Senator MCCLURE. Well, the reason I asked the question is, obviously, there are some differences between cost estimates in France and Sweden, and their cost experience, as compared to the cost estimates here.

And we're trying to find out why the difference. Is it because we're asking too many questions? Is it because we're going beyond the limits of reasons with respect to both the range of questions and the degree of certainty to which they're answered?

I again wonder if, while you said, yes, DOE is generally doing enough, are you comfortable that they're not doing more than is necessary?

Mr. THOMPSON. Well, we've been looking at it to assure ourselves that they resolve the technical issues which we must conclude on our licensing basis.

I'm not aware of any place where we think they're doing too much. DOE may think NRC is asking more questions than needed. But I guess I will let you ask DOE that question.

Senator MCCLURE. In other words, if you were doing it, you would not be doing less?

Mr. THOMPSON. I don't know that I've looked at that specific area. I don't know that I've looked at any area to say, could I do less, could we do less in this particular area.

Have we looked at anything like that, Bob?

Mr. BROWNING. No, we haven't. But perhaps one way of looking at it is to see if the site characterization plans, which of course we haven't yet formally received and commented on, are focused on what are perceived to be, at this state of knowledge, the potential Achilles heels of the sites from a licensing standpoint, as opposed to addressing all the levels of concern, maybe second or third order concerns, which may end up being licensing questions, but may not be ultimately determining whether you want to proceed with a particular site or not.

We have not looked at the plans from that standpoint yet, because we don't have them. But that's one way that they could be looked at.

I believe that there's a representative from the State of Washington who has published an article in one of the Washington State newsletters about an approach that—comparing how industry would tackle a project like this compared to a project that needs to know or wants to know every detail about the site that you could possibly ever ask.

And that might be another way to look at what's being proposed and what's being required to make sure there is some perspective in the program.

Senator MCCLURE. Mr. Browning, you earlier in one of your comments said that it's hard to compare the two programs and we should be careful not just to look at superficial numbers and say, all right, they're built one over here. They're going forward with these estimates of cost and it's far less than we're doing here.

And you suggested that there might be other factors. What do you mean by the term, other factors?

Mr. BROWNING. Well, within the site characterization plan there are elements other than what you might just think about in investigating the site through surface bore holes or exploratory shafts.

As I understand it—and again, DOE would be the proper agency to answer this question as to whether they're on an apples and apples basis—but there are numbers in those estimates, I think, of a billion dollars per detailed, or at least conceptual designs of the repository itself, which go above and beyond just characterizing the site per se.

That's what I had in mind.

Senator MCCLURE. So there may be the elements of the construction estimates, rather than just characterization?

Mr. BROWNING. Yes, sir.

Senator MCCLURE. You have emphasized in your statement the public process identified. What I'm trying to get at a little bit here, why is the NRC looking at the public process as a part of the NRC responsibility?

Mr. THOMPSON. This relates to my comments on Senate bill 839. What we have found is that in building what I would see as the technical consensus that is needed to have confidence that the facility is going to be properly licensed, a licensing proceeding allows parties to come in, participate, have access to the issues, and raise questions concerning the capability of the licensee to meet our rules and regulations.

Senator MCCLURE. Well, let me ask the question this way: I know NRC is very much involved in seeking public opinion, seeking the opportunity for intervenors, seeking the opportunity for the expression of a lot of different points of view to test the validity of your own thinking, to bring information, facts, and arguments to your attention.

Are you approaching your review and DOE and DOE's action in the same way that you can't look at licensability unless you have also at this stage involved the public in the same kind of comments?

Mr. THOMPSON. If I got the thrust of your question, is that, are we capable of reviewing and evaluating the technical issues to our satisfaction? I believe we are.

We have on our own staff the capability to review and address these issues.

Senator McCLURE. Well, if that's the case, and I don't question that, then why are you focusing on the public participation as a part of your comment on DOE's process?

Mr. THOMPSON. Well, what we were looking at there was the process to date in establishing what I believe is the acceptability, if you've looked at that area. It has been an important issue and the participation by the states and the Indian tribes has been important in the process to date.

Senator McCLURE. That has to do with acceptability. It doesn't have to do with licensability.

Mr. THOMPSON. That's correct.

Senator McCLURE. And your responsibility is licensability?

Mr. THOMPSON. Our responsibility is licensing ability and the licensing proceeding that we conduct.

Senator McCLURE. Now, later on, when you get into the licensing proceedings, you'll be interested in public participation to test your own process.

Mr. THOMPSON. That's correct.

Senator McCLURE. But I was trying to separate the two. And it seems to me your suggestions to DOE about acceptability are, at this stage, gratuitous suggestions that have nothing to do with your function.

Mr. THOMPSON. I think these were some of the issues that we identified as ones that we had some concerns and were evaluating for our Commission's considerations.

Again, these do not necessarily represent the views of the Commissioners at all.

Senator McCLURE. Well, I was just a little puzzled. Because if they're really a part of your process on licensability, I understand where you come from.

But if you're talking about, well, that really isn't it, because we can make those judgments right now technically; later on we'll get into the other question.

Mr. THOMPSON. What I was addressing, I think, was the potential conflict between the amendments act and the previous act as they related to the participation by the other parties.

And it wasn't clear to us what the amendments act of 1987 was intending to do.

Senator McCLURE. Well, I also say the same thing in your statement when you talked about the preliminary meetings at Hanford.

You cite with approval the fact that state Indian tribes were involved.

At this stage of the game, that's none of your business. It may be desirable, but it's none of your business. That's DOE's business, isn't it?

Mr. **Browning**. Under the act, both DOE and NRC have responsibility for making sure we work very closely with the host state and the affected Indian tribes.

Senator **McClure**. Surely, in the terms of your licensing process. But that's not where you are now.

Mr. **Browning**. No, in terms—even in the prelicensing process.

Senator **McClure**. In prelicensing?

Mr. **Browning**. Yes, sir.

Senator **McClure**. As you look at the technical feasibility and advising DOE, you're looking at the process? Mr. Thompson just a moment ago said you weren't; you had the capability of making the technical judgments without looking at that.

Mr. **Thompson**. As I see our area of consultation, we were looking at the process, which is separate from our technical capability. I do believe that it was—I think we were acting consistent with our understanding of what the law had intended that we do in consultation with the host state and the Indian tribes.

Senator **McClure**. I'll not belabor the subject. Thank you very much.

The **Chairman**. Senator Evans.

Senator **Evans**. Thank you, Mr. Chairman.

Mr. Thompson, it seems to me that on several occasions during your testimony you have indicated that while it is fine to go ahead with site characterization, and having three sites to characterize is apparently precisely right, that that was as much a matter of schedule as anything else.

You mentioned tight schedule. You mentioned it in your written statement. You mention it again when you were asked on what basis the number three was selected.

You said that it had to do with schedule. If—let's assume for the moment that the one billion per site is accurate, and that we should spend, to adequately characterize, one billion dollars on each site.

As the Chairman said, that's $3 billion, and even in today's budget, that's a lot of money. If it cost, let's pick a figure, it shouldn't cost this much, but say it cost a billion dollars to build an MRS.

If we were to go ahead and build an MRS which would adequately, and for an extended period of time, handle the waste and handle it safely, would that change your mind on how many sites we should simultaneously characterize for long term storage?

Mr. **Thompson**. I don't tie the building and construction of an MRS with the siting aspect of meeting and selecting a high level waste repository consistent with the year 2007 or 2003.

Senator **Evans**. Leave the 2007 or 2003 apart. If you have an MRS constructed, if it were constructed in the next ten years, and material could be safely stored there for 50 years, or 70 years, or 100 years, for that matter, you don't have to meet 2007.

Mr. Thompson. Yes, sir. We've looked at the MRS aspects, as you know, that's been proposed, and we looked at it from the concept of public health and safety.

And we saw that there was no need for an MRS from the public health and safety aspects. Nevertheless, the MRS does provide some operational flexibility, specifically along the lines that you discussed, providing DOE and the utilities some capabilities to handle the spent fuel activites, as well as some capabilities and benefits to the regulatory aspect.

So it does provide certain advantages over not having an MRS.

Senator Evans. Well, that was an interesting statement, but it wasn't responsive to my question.

The question was: If you could build an MRS for a billion dollars, and let me add this assurance that we have had, as Mr. Browning points out, we have had from the Department of Energy as well as from the French, that they feel the potential of successful site characterization for any of the three sites now being suggested is in the high nineties; it's a question of whether it's 97, 99, or 99.44 percent pure.

Does it make sense, if you had an MRS in being, or moving ahead on it, to still go ahead and spend $3 billion to characterize three sites simultaneously, if you knew you didn't have to meet the kind of schedule that is currently in the act?

Mr. Thompson. That's kind of a difficult judgment for me to make. I'll be glad to give you my personal views, as opposed necessarily to the Commission's.

There are a number of site characterization activities that you can continue, if you had a reasonable confidence that the best site was selected, not one that you had some major concerns on, I think it does make sense.

I think it makes some sense in that it would do two things. One, it would allow NRC to focus our resources and our reviews to one site, as well as it would allow DOE to focus their own management and resources to one site.

This again would hopefully give some confidence that the process—and the talent that we have in both organizations—wisely utilizes the resources that we both have available.

Tying that specifically to the safe storage at MRS just provides some additional flexibilities. I don't see a significant tie to the MRS in that aspect.

Senator Evans. Do you think it's better to leave the stuff at reactor sites for an extended period of time?

Mr. Thompson. No, my belief it is better, and it provides operational flexibility, to have an MRS, although I don't think it's necessary for public health and safety.

Senator Evans. Okay, but if it's better, and potentially is cheaper—let's just look at it practically. If it costs a billion dollars, and these are assumptions, obviously, but if it costs a billion dollars to build an MRS, and as a result, you felt safe, or at least there was the opportunity to site characterize the best site first, and you're 97, 98, 99 percent sure you're going to make it successfully, haven't you just saved a billion dollars?

Mr. Thompson. Yes, sir.

Senator Evans. Mr. Browning, would you agree with that?

Mr. BROWNING. Yes, sir.

Mr. THOMPSON. Actually, might even save two billion, but I don't want to get too far ahead.

Senator EVANS. Let me just ask one other question. You indicated in your testimony that the Department had done its job well in the selection of three sites, for site characterization, and there was no technical reason not to proceed with site characterization at these three sites.

Isn't it also accurate that you have said you did not investigate, other than technical reasons, in the process of selecting the three sites from among the several that were under consideration, and before the three were picked?

Mr. THOMPSON. That is correct.

Senator EVANS. You have not looked at relative costs, you have not looked at any of those characterizations?

Mr. THOMPSON. That is correct. We did not look at those aspects.

Senator EVANS. Thank you.

The CHAIRMAN. Senator Ford?

Senator FORD. I'm trying to figure out what path we're going down here, Mr. Thompson. I need a whittler and a spitter to help me a little bit.

Do I understand you correct that all three sites, regardless of the charges of the various states, that you believe that based on your review, that it merits to continue to the characterization of the three sites?

Mr. THOMPSON. Yes, sir, we do believe that DOE should continue the characterization programs.

Senator FORD. So regardless of what the states say, and call it inadequate or incomplete or manipulated data, that sort of thing, some of the states, and particularly one, regardless of those kind of charges, you think you ought to proceed ahead?

Mr. THOMPSON. We see no technical reason for DOE not to proceed ahead at this time.

Senator FORD. Is there any judgment that you can make that the sites selected won't—maybe it's already been alluded to—but is there any judgment at this point that the chances of a site selected for characterization will be found licensable?

Mr. THOMPSON. Our belief is that at least one of these sites will certainly be found licensable.

Senator FORD. At least one of them?

Mr. THOMPSON. Yes, sir.

Senator FORD. And you're probably not in the position to say which one so we can make $2 billion today. [Laughter.]

Should we be concerned that DOE is recklessly charging ahead with flawed sites?

Mr. THOMPSON. I'm not exactly sure what the recklessly charging ahead with flawed sites——

Senator FORD. The states have charged DOE with that situation, proceeding in that manner.

Mr. THOMPSON. I'm sorry, sir?

Senator FORD. The states have charged, those three states that have been selected, they've charged that DOE is recklessly charging ahead with flawed sites.

Mr. THOMPSON. I would not say these sites are flawed. What I would say is that there are programs and efforts, in fact we had discussions with DOE, in doing site characterization efforts that can be done prior to sinking the shaft, and that those are important to be done early.

I know there is some concern that DOE may want to sink a shaft, say at the Hanford site, as soon as possible; and that those issues are often subject to schedule issues, which we think may best—the program that they have identified may best be focused on doing the site characterization activities prior to sinking a shaft, rather than expending the considerable funds to sink the shaft.

So I don't see anything reckless, although there might be some minor differences of opinion as to when to sink a shaft.

Senator FORD. Well, that doesn't mean they're necessarily reckless, then, does it?

Mr. THOMPSON. I do not see anything I would characterize as reckless, no, sir.

Senator FORD. Well, let me ask a couple of questions.

Last month, two of my colleagues from Tennessee expressed their concern that NRC had not fulfilled its statutory requirement to evaluate the need for monitored retrievable storage in the waste management system.

Would you response to their concern?

Mr. THOMPSON. Yes, sir. I recognize the Commission did respond to that letter from Senators Gore and Sasser, and with your permission, sir, I'd like to include that in the record.

It was a letter from the Chairman dated April 27, 1987.

The CHAIRMAN. Without objection, we will put that letter in the record.

[The letter follows:]

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

CHAIRMAN

April 27, 1987

The Honorable Jim Sasser
United States Senate
Washington, D.C. 20510

Dear Senator Sasser:

I am responding to the March 31, 1987 letter from you and Senator Gore concerning the need for the Department of Energy's (DOE) Monitored Retrievable Storage (MRS) facility as contained in the provisions of the Nuclear Waste Policy Act (NWPA). As your letter states, the NWPA requires DOE to consult with the Nuclear Regulatory Commission (NRC) and to submit NRC comments on the MRS proposal to the Congress at the time the DOE proposal is submitted. However, as we understand the NWPA, the Congress left it for NRC to decide which particular aspects of a DOE MRS proposal warrant NRC comment. In examining the DOE proposal, NRC decided that its most useful role would be to focus its comments on subjects falling within its later licensing responsibility. In preparing our comments, we regarded the matter of need as primarily a business decision within the overall waste management system by which DOE intends to implement the NWPA. We did not view the MRS as needed for protection of the public health and safety.

The proposal was therefore examined from the perspective of the licensability of the facility if authorized by Congress, specifically from the standpoint of its design adequacy to protect the public health and safety. The NRC reviewed the DOE evaluation of need for the MRS but, in keeping with the focus of its comments, assumed a neutral posture.

With respect to your question on need, we believe there are attractive benefits, both operational and regulatory, to be gained by providing an MRS as part of an integrated high-level waste disposal system. These benefits are worthy of serious consideration even if an MRS is not essential for the protection of the public health and safety. Examples of operational benefits derived from an MRS integrated into the high-level waste disposal system include:

- o flexibility for the DOE waste management system by decoupling the repository from the reactors and reactor sites;

- simplification of the surface facility operations at the repository;
- a firmer base for utilities to plan for their fuel storage requirements;
- early planning and focus for the DOE transportation system.

In addition to the operational benefits MRS presents certain regulatory benefits, particularly with respect to resource expenditures. Utilities are taking steps to handle and store more spent fuel at one or more of their reactor sites. Two utilities, which own multiple reactor sites, already have been licensed to use dry storage of spent fuel. These are in effect small local MRS facilities. A DOE MRS, as proposed, would permit:

- fewer designs for handling and storage to be reviewed, licensed and constructed;
- fewer sites and methods for spent fuel rod consolidation and packaging;
- fewer surveillance demands and more focused inspection;
- a greater degree of quality assurance with this simplicity;

The staff also examined alternatives to the MRS considered by DOE which seem to have neither the operational nor regulatory advantages of the MRS as presently contemplated. For example, the use of the MRS as a backup or near-term alternative to a repository would accrue fewer of the benefits and most of the costs when compared with the MRS as an integrated step in the system for high-level waste disposal. Should MRS not be authorized, all packaging and storage operations would then be carried out at reactor sites and the repository. While it is technically feasible to safely store all fuel at reactor sites until a repository is ready under its current schedule, additional regulatory and operational benefits identified in the previous paragraphs would not be realized.

You expressed concern that the Department of Energy is pursuing a course that will ultimately result in a de facto final repository in Oak Ridge, Tennessee. We do not agree that DOE's proposal for an MRS is premised on an assumed probability that a final repository will never be completed. We believe that DOE is actively pursuing a program aimed at siting and developing a deep geologic repository for disposal of high-level waste.

In conclusion, while there are operational and regulatory benefits to be gained from an MRS as part of an integrated system for high-level waste disposal, they are not essential for safety. An MRS holds potential for providing management flexibility for addressing and responding to the institutional complexities of the waste management system.

The Commission believes the question of need mainly reduces to economic considerations and the role the MRS might eventually play in reaching a final solution to the problem of high-level waste disposal. Although we recognize the regulatory benefits associated with an MRS, these policy issues are best addressed by DOE and elected officials who provide the impetus to the program rather than the NPC.

Commissioner Asselstine is on official travel and did not participate in this response.

Sincerely,

Lando W. Zech Jr.

Lando W. Zech, Jr.

Senator **Ford**. Well, that's yesterday.

Mr. **Thompson**. Yes, sir.

Senator **Ford**. It's nice that we have hearings, so we can get answers.

Mr. **Thompson**. If you would like, I can read some——

Senator **Ford**. As long as it's in there.

Now, does the NRC staff feel that there are any public health and safety benefits to be gained from the addition of an MRS to the waste management system?

Mr. **Thompson**. I would say that the public health and safety benefits are not significant, although they may be important, in the sense that, we, having one MRS facility to focus our inspection resources, our licensing resources, as well as our quality assurance resources, will result in a higher confidence that an MRS will meet the type of standards and performance that we would look at, as opposed to having some 40 to 50 mini MRSs around the country, operated by different organizations and utilities.

Senator **Ford**. Is there any danger in your mind, any greater danger, with the storage on generating sites than with one major MRS taking into consideration the transportation problems?

Mr. **Thompson**. I don't see transportation problems as creating a significant danger from single sites, versus transportation to an MRS and then moving to a high level repository eventually.

Senator **Ford**. You may not, because you understand the situation, but the general public has problems with it. And many states are beginning to look now at where the transportation may go, and training sheriff's departments and that sort of thing.

And you go into some of the counties in my state, you've got the sheriff, and he's the only county official, and maybe his brother's deputized and he works to help him for nothing.

And those in surrounding areas are quite concerned if an accident occurs in that county, and you've got one fellow that's trained to do it, he may be on vacation.

I'm just talking about lots of things that I'm trying—if Dr. Weinberg, his original decision was to have several, I think he mentioned 80, and if they cool, and the public feels more comfortable with that, and there's no inherent danger in those several sites, why wouldn't it be just as well to do that, and then move them at a later date when the constituency would have a greater confidence?

I'm going through the nerve gas situation removal from storage sites, some of the others. And the small communities adjacent to the area are passing ordinances that refuse to allow it to be transported.

Now, that may be a little different, nerve gas and nuclear waste. But they're both scary, if you don't understand it, to the constituency.

I'm just trying to find a safe way, won't cost us quite as much, and we're looking at the public confidence. You know, public confidence was eroded this morning, if you read the paper.

You can comment on that if you want to. If not, you can throw it up, and Nevada will get to you here in a minute.

Mr. **Thompson**. You would like to have me comment on the transportation aspects?

Senator FORD. Yes, I'm talking about, I'd like to know if you feel as confident in the safety of several small units, rather than transportation to a major unit and leave it there, in an MRS, and then send it on to the redepository.

Mr. THOMPSON. I basically feel as comfortable with the public transportation and the protection of the public, primarily based on the level of review that we give our shipping casks.

These casks provide a significant level of protection of the public from radiological health and safety. I don't have any major concerns that the public would have any significant problems of exposure to radiation from the transportation or even a transportation accident.

We do think it's important that once a specific repository would be identified, that as part of that, it would be the responses to emergency planning, responses to transportation accidents, and we would look at that aspect of it.

Senator FORD. Thank you, Mr. Chairman.

The CHAIRMAN. Senator Hecht.

Senator HECHT. Thank you, Mr. Chairman. If you will excuse my tardiness today, it isn't very often in one's life that his senior Senator has a press announcement: Laxalt for President.

Senator FORD. Oh, I thought it was you, since you're the senior Senator from Nevada. You are the senior Senator, aren't you?

Senator HECHT. But Paul has always been my senior Senator, see.

Senator FORD. He was senior to me as governor, too, so that's all right.

Senator HECHT. That is correct.

I don't know whether these questions have been asked, but I would like to hear it for my own mind. We had a trip to Sweden and France, and our distinguished chairman, and I think I certainly could not congratulate him more for going over there and seeing how other people handle the nuclear waste and the complete nuclear cycle, which is, I think, very, very well handled.

We came back very, very impressed with the whole nuclear policy, and France has taken the initiative just like Sweden did.

The two glaring differences I found in the way we are looking at our nuclear waste, and the way Sweden and France is handling theirs, that's the time for these nuclear spent fuel rods to cool down. They're having it in the swimming pool concept, the MRS facility, for 40 to 50 years.

Would you comment, if you've done it before, I would appreciate it if you'd do it again. Would you comment on that?

Mr. THOMPSON. I have not commented on that. I do believe that the fact that the spent fuel could cool both thermally and radioactively would provide, I guess, less of a challenge to the design requirements for high level repository, than the current approach, which I guess is a 10-year timeframe before the spent fuel would be entering into the repository.

So those aspects are important ones, and they are ones which I think would make a difference in whatever the design characteristics of the facility, or they would make a difference in the margin that would exist in a currently designed——

The CHAIRMAN. Would the Senator yield at that point?

Senator HECHT. Of course.

Senator FORD. Are your requirements now, do you see it as your requirements, to have a 10-year capability, in other words, that you receive the wastes after only ten years of cooling down?

Mr. THOMPSON. I don't believe we have a specific requirement whatsoever with respect to the waste. What our requirements are, is the system, once the waste is placed in the repository with respect to its capability to meet our siting requirements, our licensing requirements.

The CHAIRMAN. But the licensing requirements would be considerably less if you could cool those wastes for, say, 30 or 40 years?

Mr. THOMPSON. I would say it slightly differently. I would say the licensing requirements would stay the same. The ability to demonstrate that the system as designed to meet those requirements would be easier.

The CHAIRMAN. Thank you.

Senator HECHT. Well, they have showed us scientific charts that the first 30 or 40 years, it just sort of goes like that, and 50 years, and then it sort of evens out, that it cools down; after that, it's much easier to handle. You can pack it closer together. And the containers that you can keep it in are certainly different.

Would you comment on that? Excuse me, it was handed to me, and I thank you very much. Those are in the record.

Mr. THOMPSON. I believe that's a correct statement. I don't know that it goes flat after 50 years, but the general concept of a significant decrease in the timeframe of 30–40 years it would be, I don't know precisely, but it's like a factor of three decrease in the level of heat that's generated.

Senator HECHT. If you feel this way, why have you not incorporated this concept into our waste program?

Mr. THOMPSON. I don't think that that's part of our responsibility to do that. We have no objections to that being part of the program.

Our responsibility is focused on the adequacy of the siting itself. And we had not looked at that as a requirement. We are looking to see if in fact the fuel that is to be put there is ten year old fuel, we would look at what that particular performance characteristic would be, and want to have assurance that fuel of that vintage would be adequately protected.

So we have no objection to it going to be a 30-year-old fuel.

Senator HECHT. Well, we're looking at 30, 40 or 50 years over there. Because they have not, even in France with their long range policies, have not even begun to go into the long range storage; they're still there. And before they put it into the ground, they want to take everything out of it.

Which is my next question: How do you feel about our civilian waste and military waste being handled differently?

Mr. THOMPSON. I guess Mr. Browning might want to comment on that. I'm not familiar with the details of the military waste and its program.

Mr. BROWNING. I assume you're referring to the fact that the military waste has been reprocessed——

Senator HECHT. That is correct.

Mr. BROWNING [continuing]. And the liquid high level waste is converted to glass?

Senator HECHT. That is correct.

Mr. BROWNING. I don't think the Agency really has a position on that. It's primarily an economic matter. From a standpoint of being able to make a licensing case as to how the waste repository will perform after the waste is disposed of, and predicting how that's going to perform for 10,000 years, I think it would be an easier case for both the Department of Energy and for us to deal with if all the waste looked the same.

Senator HECHT. Were the same?

Mr. BROWNING. As opposed to, you know, two different kinds of waste going into the repository.

But we don't have any regulatory requirements that would force it one way or the other. I think that was discussed during earlier testimony, that it's primarily an economic question.

Senator HECHT. Well, we understand the economics today, but the economics today might not be the economics 20 years from today, or as you say, 10,000 years from today.

So would you feel that the safest way would be the best way, and forget economics?

Mr. BROWNING. Well, again, that's outside NRC's area of responsibility, the economic or cost aspects. From a public health and safety standpoint, I think it can be made to be acceptable either way.

But it would be easier. I don't think there's any question that it would be easier if you had to deal with one particular component in a repository. But either way, we could deal with it.

Senator HECHT. Mr. Chairman, I have many questions from my home state, and time will not allow me to go over these. May I submit these questions for the record?

The CHAIRMAN. Yes, we will have a number of written questions which we would appreciate your answering.

Senator HECHT. Okay, my time is up.

The CHAIRMAN. Senator McClure had one additional question.

Senator MCCLURE. Mr. Chairman, I thank you.

I noted in the letter the Chairman sent to Senator Sasser dated yesterday, and I think that's been made a part of the record, reference has been made to a fact which has perhaps been little noted, but perhaps ought to be noted further.

With respect to the licensing of facilities at the site of commercial reactors, and I think two points need to be made at this juncture: one, when the Nuclear Waste Policy Act was passed, this committee had been informed and was, I believe, under the impression that such licensing by NRC would be a difficult and time consuming activity, and perhaps unpredictable, and that power plants would not be able to rerack or go to other forms of at-site storage, and therefore, would not be able to refuel reactors starting in the early 1990s.

You have, as a matter of fact, been able to work with utilities and grant licenses for the kind of storage at the site which changes that date.

You've done that by two means, if I recall correctly, and I ask if this is correct: One is reracking, which allows a greater number of fuel assemblies to be put in the same facility, and at least two utilities that have multiple sites have been granted licenses for dry cannister storage; am I correct?

Mr. Thompson. I believe that's correct, yes, sir.

Senator McClure. Now, in the event of either form of storage, has the license that has been granted placed a time limit or a life limit on those storage facilities?

Mr. Thompson. I don't know the specifics, and I'll get back to you for the record, but normally, when we would grant a modification for reracking of the spent fuel pools, that would be consistent with the life of the facility, that is, it would have a timeframe of about 40 years, either from the time of the construction permit, depending on the timeframe or 40 years from the time that the operating license was granted.

And I'm just told by Mr. Cunningham that in fact for the dry cask there was a time limit for the dry canister storage, and that was 20 years, with a renewal at the end of 20 years.

Senator McClure. But 20 years from the time the storage was initiated?

Mr. Thompson. That's correct.

Senator McClure. Do you recall how old those spent fuel assemblies are before they're placed in dry canister storage?

Mr. Thompson. Let me ask Mr. Cunningham, who's in charge of that review. Do you know, Dick?

Mr. Cunningham. The regulations require it to be at least one year old. In point of fact, the fuel that is going into the two utilities that are currently licensed I believe is over 10 years old.

Senator McClure. But that's not a licensing requirement. That's just a fact.

Mr. Cunningham. That's a fact.

Senator McClure. All right. Can you supply for the record what your information shows with respect to the thermal heat and radioactive nature of those canisters at the one year period, when you've said that the requirement is, and the 10-year period where the fact is?

Mr. Cunningham. Yes, sir.

[The information follows:]

INSERT FOR THE RECORD
SENATE COMMITTEE ON ENERGY AND NATURAL RESOURCES HEARING ON HIGH-LEVEL WASTE/MONITORED RETRIEVABLE STORAGE
[APRIL 28, 1987]

At the hearing before the Committee on Energy and Natural Resources held on April 28, 1987, a question was raised with respect to the thermal heat and radioactive nature of spent fuel. This is in response to that question. Under 10 CFR Part 72, the NRC's regulation covering the storage of spent fuel outside of reactor basins, fuel must have decayed at least one year or more before removal from the reactor basins to storage. This requirement eliminates short-lived, volatile radioactive materials, which have decayed away. In actual cases, where dry storage of spent fuel has been licensed, license technical specifications based on the design of the containers authorized provided that spent fuel is required to have decayed five years or more. Such provisions assure that spent fuel is stored at temperatures (generally below an initial fuel cladding temperature of 380°C) which do not allow for any significant degradation of the structural properties of a spent fuel assembly over at least the 20 year licensed period of storage. Thus, actual limitions on the age of spent fuel in dry storage are design and fuel dependent. The table below shows total radioactive material and heat content at one year, five years, and ten years cooling times.

Thermal Heat and Radioactive Nature of Spent Fuel*

Cooling Time, Years	Radioactivity, Curies/MTU**	Heat Content watt/MTU
1	2,230,000	9400
5	589,000	1900
10	418,000	1230

* Basis: Fuel burnup of 33,000 Megawatt - days/MTU

** MTU = metric ton (i.e., 1000 kilograms) of uranium fuel

Senator McClure. If this is true, do you see any problem with the continuation of that process with all 100 reactor sites?

Mr. Thompson. Well, we did as a note in our letter, that there are some aspects that, I guess I should say, regulatory advantages. One, there would be fewer designs for handling and storage to be reviewed, licensed, and constructed. That's just the process that we would have to go through.

Senator McClure. Let me phrase the question a little differently. I shouldn't say, are there any problems, but, do you see anything that prohibits a continuation of this process?

Mr. Thompson. No, sir, we see nothing from a public health and safety issue that would prohibit that.

Senator McClure. So if the program for an MRS or a geologic storage, either one, were delayed beyond the timetables set forth in the current law, we're not now faced with the probability or the likelihood of plant closure or shutdown because of the inability to refuel?

Mr. Thompson. There are mechanisms by which the utility, and I guess alternatives available to the utility to be able to handle and store spent fuel.

I do believe the Commission would be obligated to look at its waste confidence proceeding in a more formal process, and that my comments are just my understanding from the technical issues, not to preclude the Commission from looking at that issue in a very deliberate way.

Senator McClure. I think one of the things we have to look at, and we will certainly get to as we talk to Mr. Rusche, is the attainability of the timetables established in the statute.

And as I think you know, we're already beyond the ability to meet those time deadlines. Isn't that fair to say?

Mr. Thompson. That certainly is a fair conclusion.

Senator McClure. Thank you very much.

The Chairman. Thank you very much, Mr. Thompson, gentlemen. You've been very helpful to the committee.

Mr. Thompson. Thank you.

The Chairman. Next we have Dr. Frank Parker, who is Chairman of the Board on Radioactive Waste Management of the National Academy of Sciences.

STATEMENT OF DR. FRANK L. PARKER, CHAIRMAN, BOARD ON RADIOACTIVE WASTE MANAGEMENT, NATIONAL ACADEMY OF SCIENCES, ACCOMPANIED BY DR. PETER B. MYERS, STAFF DIRECTOR

Dr. Parker. Mr. Chairman, Senators, with your permission, I would like to ask that Dr. Peter Myers, the staff director for the Board, also accompany me.

The Chairman. Delighted to have Dr. Myers.

Dr. Parker. In order to save time, Mr. Chairman, I will paraphrase my statement as long as it will be entered into the record.

The Chairman. Yes, it will be entered in the record.

Dr. Parker. I am here in my role as Chairman of the Board of Radioactive Waste Management of the National Research Council, National Academy of Sciences.

For the past 20 years I've been professor of environmental and water resources engineering at Vanderbilt, University, in Nashville, Tennessee.

Prior to that time, I had been chief of the radioactive waste disposal research group at Oak Ridge National Laboratory, and also, at the International Atomic Energy Agency in Vienna.

Though I have lots of material here, and professors are used to talking for 50 minutes, I will curtail those remarks.

I am pleased to be here to explain the role of the Board of Radioactive Waste Management in the review of DOE's work, as you asked me in your letter.

As you know, the Academy was chartered by the Congress in 1863 to serve as an official adviser, and upon request without fee, to the Federal Government on any question of science or technology.

Our Board has, at the present time, 11 members who have expertise in environmental engineering, seismology, physics and public policy, rock mechanics and mining, health physics, oceanography, geohydrology, geochemistry, risk assessment, and public policy.

The Board does not set up projects on its own; it can only recommend projects to the Commission of the National Research Council, in addition to which we do not choose the members of the panel, we can only recommend members of the board or panels which work under the board to that commission.

At the present time the board has active panels looking at the waste isolation pilot plant for transuranic waste in Carlsbad, New Mexico, and at the disposition of the waste within the single shell tanks at the Hanford reservation.

Panels have recently completed studies on waste disposal at the Oak Ridge National Laboratory, and about the disposition of uranium mill tailings.

I'd like now to turn to the interactions that we have had with the Department of Energy on the siting and characterizations of three sites for high level waste repository.

Initially, we looked at the methodologies in the draft environmental assessments, average pairwise comparison and utility estimation. And as you note, we found that that methodology was deficient.

After that, the Department of Energy did revise that methodology and asked the board to conduct an independent review of the methodology to be used to evaluate sites for consideration as candidate sites for the characterization of the first geologic radioactive waste repository.

The Department of Energy then sent the board a generic description of the revised methodology utility estimation, a multi-active utility theory, met with the board. The board found that the methodology paper which they presented to us was only the basic concepts of multi-active nuclear utility theory, with a few simplified illustrative examples.

The board was able to commend the Department of Energy for the adoption of a rigorous form of this decision aiding methodolgy. However the board felt that without documentation of the Department of Energy's application, that it would not be possible to determine whether or not our concerns about the adequacy of site rankings, the appropriateness of documentation, and the potential for bias in applying the technique had been resolved.

The full text of all of these statements are included, of course.

After that, Mr. Rusche asked the President of the National Academy of Sciences, Dr. Press, that the board conduct a comprehensive review of the analysis.

The portions of the report that were sent to the board included background information on the repository program; the siting process; post-closure analysis of all the sites; and pre-closure analysis of one site.

Neither the comparative analysis of preclosure sites, nor of the aggregate ratings, were given to the board.

On April 10th, 1986, the board sent to the Department of Energy its review of the portions of the draft of the final candidate site recommendation report. The full report text is given in the appendix.

The board stated, and I think here I should quote: It is neither appropriate nor the intent of the board to address the ultimate ranking or the recommendation of specific sites, both of which go beyond the implementation of decision-aiding methodology.

The board chose not to review, and at its own request, did not have access to, the Department of Energy's ranking on preclosure factors; rankings combining post-closure and pre-closure factors, using the decision-aiding methodology, or the final recommendation of sites for the characterization.

The board commended the Department of Energy for the high quality of the work which we did review on methodology. But we did not review in detail the data and the judgments on which conclusions from the multi-active procedure were based.

The board believes that there is no single, generally accepted procedure for integrating technical, environmental socio-economic, and health and safety issues for ranking sites.

The multi-attribute utility method used by the Department of Energy is a satisfactory and appropriate decision-aiding tool.

The board was disappointed the Department of Energy did not use outside experts in this assessment process, as well as in the review of the process.

Despite these misgivings, we have seen nothing to indicate bias in the implementation of the method; and note that the Department of Energy's sensitivity analysis, which was applied to the post-closure issues, indicates that the rankings on these issues would not have changed with reasonable or plausible changes in the parameters and judgments.

The Board has emphasized the desirability of having a probabilistic performance assessment of the post-closure factors at each site.

The board also noted that the expected total repository and transportation costs would be a major, if not the controlling factor, on the rankings under pre-closure.

This recognition reinforced the board's judgment that the principal usefulness of the multi-attribute utility method is to illuminate the factors involved in the decision, rather than to make the decision itself.

Finally, on this issue, the board recognized that there are factors other than the multi-attribute decision analysis to be taken into account in the final decision to elect three sites for characterization.

These other factors include the diversity of rock types required by the Nuclear Waste Policy Act of 1982; judgments about the ability to license successfully, including consideration of waste package performance and judgment about the best set of sites to choose to assure the highest likelihood of a licensable site emerging from the characterization process.

After our letter, as you well know, the Department of Energy published documentation on the methodology, and the Secretary of Energy made the recommendation to the President of the three sites, Yucca Mountain, Deaf Smith County, and Hanford Reservation, who were selected to be characterized as candidate sites.

After that time, the director of the Office of Radioactive Waste Management Ben Rusche, requested the President of the National Academy of Sciences to provide scientific and technical advice during the site characterization phase of the repository program.

The President of the National Academy of Sciences responded favorably to this, and these letters are, again, included as appendices.

And the Board has proposed a statement of work, which is also included, to review the scientific and technical adequacy of documentation supporting portions of the program for site characterization; performance assessment for the repository and waste packages; and implementation of the experimental program.

The panels will not consider nontechnical aspects of site characterization, nor provide independent verification of the accuracy of raw data, nor assess overall program adequacy, or evaluate site adequacy for repository use.

To make our review process more transparent and open, and to avoid duplication, we have met twice with the affected states and Indian tribes, and with the Nuclear Regulatory Commission, to exchange viewpoints.

To make clear how we intend to proceed, we have proposed draft operating procedures. In those procedures, we have made the proposal that all documents submitted to the panels will be available without restriction to other interested parties.

The contract to fund the operations of the panels has not yet be signed, nor have the panels been appointed. Consequently, it's not possible to say precisely how the panels will operate.

Perhaps a brief review of our experiences with the WIPP panel for the State of New Mexico may be illuminating.

This panel was established in 1978 at the request of the Department of Energy to review the scientific and technical criteria for guidelines for designing, constructing and operating a waste isolation pilot plant for isolating radioactive wastes from the biosphere.

We undertook to review the scientific and technical adequacy of these topics. The panel issued a final report called The Review of the Scientific and Technical Criteria for the Waste Isolation Pilot Plant.

The members of the panel are shown also in the appendix.

The initial panel in its report found that the scientific work had been carried out with a high degree of professional competence, and that the geology determined by underground exploration and measurements generally confirmed the geological expectations derived from surface explorations and boreholes; but that some issues about the hydrology and design of the facility should be resolved before the large scale emplacement of transuranic waste begins.

During that study, the panel worked closely with the Department of Energy, and its contractors, the State of Mexico, and the City of Carlsbad, and held public meetings to elicit the views of the scientific and technical critics of the plan.

We did not deal with packaging of wastes at the originating sites; transport to the sites; transport vehicles; nor the disposal of heat generating waste.

The panel, as are all Academy panels and boards, was composed of volunteer workers on a parttime basis, and therefore, we benefitted enormously by the work carried out by the Department of Energy and its contractors, particularly the Sandia National Laboratory, and the work and critique of the State of New Mexico's environmental evaluation.

We believe the report was a useful compilation of the views of the panel, but we feel that the interactions between the panel and the Department of Energy and the Environmental Evaluation Group were most useful.

Maybe the most important thing that came out of our review of the WIPP site was the decision that a shaft should be put down to the projected emplacement horizon with tunnels excavated to carry out tests and observations to resolve the remaining site-specific technical uncertainties.

I think we were the first to call for this, but we believe that in only this way could an adequate understanding of subsurface conditions be obtained.

Perhaps the usefulness of the panel and hopefully the new ones can be inferred by the fact that when the National Research Council was deliberating whether or not to reconstitute the panel for an additional 4 years, both the Department of Energy and the State of New Mexico sent letters to the Council urging them to continue the overview of the WIPP panel.

The Board expects its panels to follow procedures similar to those of the WIPP oversight panel and the oversight of the three proposed sites for characterization. At present, the proposal for the establishment of the three panels is in the Research Council's internal approval cycle. When approved, it will be delivered to the Department of Energy, and further progress then will be coupled to their procurement process.

Mr. Chairman, Senators, on behalf of the Board of Radioactive Waste Management of the National Research Council, I want to thank you for the opportunity to appear here today. If you have any questions, I shall be pleased to try to answer them.

[The prepared statement of Dr. Parker follows:]

TESTIMONY OF FRANK L. PARKER
PROFESSOR OF ENVIRONMENTAL AND WATER RESOURCES ENGINEERING
VANDERBILT UNIVERSITY, NASHVILLE, TN
AND
CHAIRMAN, BOARD ON RADIOACTIVE WASTE MANAGEMENT
NATIONAL RESEARCH COUNCIL / NATIONAL ACADEMY OF SCIENCES
BEFORE
U.S. SENATE COMMITTEE ON ENERGY AND NATURAL RESOURCES
APRIL 28, 1987

Mr. Chairman and Senators:

I am pleased to be here to explain the role of the Board on Radioactive Waste Management in the Review of DOE's work. As you know, the Academy was chartered by the Congress in 1863 in legislation signed by President Lincoln to serve as an official advisor, upon request and without fee, to the federal government on any question of science or technology. The Board is under the supervision of the Commission on Physical Sciences, Mathematics, and Resources, one of the major units of the National Research Council, which is the operating arm of the National Academy of Sciences, National Academy of Engineering and the Institute of Medicine.

At the present time, the Board has eleven members representing a variety of scientific, technical and public policy disciplines. The Board meets approximately four times a year to deal with various technical topics of concern to the Nation. Topics for study may be recommended to the Commission by the Board, based upon requests to it or the NAS, or upon its own initiative. In some instances, the creation of panels, under the jurisdiction of the Board, may be recommended to study such topics. The Board also recommends to the Commission at least two names for each position on a panel. Presently, the Board has active panels looking at the Waste Isolation Pilot Plant for Transuranic Waste at Carlsbad, New Mexico, and at the disposition of the wastes within the single shell tanks at the Hanford Reservation. Panels have recently completed studies on waste disposal at the Oak Ridge National Laboratory and the disposition of uranium mill tailings.

The Committee, though, I believe, is interested in the interactions of the Board with the Department of Energy on the selection of a site for the mined geological repository for high level and transuranic wastes. I shall describe them briefly and with reference to the original letters and reports which are attached to this testimony.

On March 22, 1985, the DOE briefed the Board on the three methods used to aggregate scores to rank the five sites proposed for nomination as suitable for site characterization by post-closure guidelines, pre-closure guidelines, and overall. These methods--averaging, pairwise comparison, and utility estimation--were published in the Draft Environmental Assessments in December 1984. Our comments, based on our review of Chapter 7 and Appendix B, transmitted to the DOE on April 26, 1984, focused on three major concerns:

- "The methodology of comparative assessment is unsatisfactory, inadequate, undocumented, and biased, and should be reconsidered in accordance with the following paragraphs;
- Insufficient weight and attention are placed on the clear need to find a site adequate under the post-closure guidelines before considering its relative rank under pre-closure guidelines; and
- Quite apart from the question of technical acceptability, the presentation of the methodology of comparison is sufficiently important that it should be highlighted as a stand-alone issue separate from the earlier parts of Chapter 7 which speak to site suitability."

The full text of our comments is Appendix 1.

On August 29, 1985, the Director of the Office of Civilian Radioactive Waste Management, Ben C. Rusche, informed the Board that DOE had revised its proposed methodology and requested NAS to conduct an "independent review of the methodology to be used to evaluate sites for consideration as candidate sites for characterization for the first geologic radioactive waste repository." The full text of the letter is attached as Appendix 2.

In September 1985, DOE sent to the Board a generic description of the revised methodology and met with the Board during October 1-3, 1985 to discuss the methodology. On October 10, 1985, the Board sent to DOE its review of the methodology and found that, although the Department of Energy's August methodology paper presented only the basic concepts of the multi-attribute utility technique, together with a few simplified illustrative examples, the Board was able to commend DOE for its adoption of a rigorous form of this decision-aiding methodology. However, the Board also noted that without the documentation of DOE's implementation of the multi-attribute utility technique, it would be unable to determine the extent to which the Board's earlier concerns about the adequacy of site rankings, the appropriateness of documentation supporting and describing the results, and the potential for bias in applying the technique had been resolved. The full text of our review is attached as Appendix 3.

On October 30, 1985, Mr. Rusche, in a letter to Dr. Frank Press, President of the National Academy of Sciences, requested that the Board conduct a comprehensive review of the implementation. This letter is attached as Appendix 4. The Board agreed to carry out such a review and met with DOE on December 12-15, 1985, and on March 24-25, 1986, to discuss the portions of the report submitted to the Board. The portions of the report sent to the Board included background information on the repository program, the siting process, the post-closure analysis of all the sites, and the pre-closure analysis of one site. Neither the comparative analyses of pre-closure sites nor the aggregate ratings were given to the Board.

On April 10, 1986, the Board sent to DOE its review of the portions of the draft of the final candidate site recommendation report it had requested and examined. The full text of the review is given in Appendix 5. It is important to understand what the Board did and did not do. The Board stated, "It is neither appropriate nor the intent of the Board to address the ultimate ranking or the recommendation of specific sites, both of which go beyond the implementation of the decision-aiding methodology...The Board chose not to review, and at its own request, did not have access to, DOE's rankings on pre-closure factors, rankings combining post-closure and pre-closure factors using the decision-aiding methodology, or the final recommendation of sites for characterization." Further, although the Board commended DOE for the high quality of the work we reviewed on the implementation of the methodology, the Board did not undertake to review, nor did it review in detail, the data and judgments on which the conclusions for the multi-attribute procedure were based. The Board believes that although there is no single, generally-accepted procedure for integrating technical, economic, environmental, socio-economic and health and safety issues for ranking sites, the multi-attribute utility method used by DOE is a satisfactory and appropriate decision-aiding tool. The Board was disappointed that DOE did not utilize outside experts in the assessment process as well as in the review of the process. Despite this misgiving, we have seen nothing to indicate bias in the implementation of the method and note that the DOE sensitivity analysis applied to post-closure issues indicates that the rankings on these issues would not change with reasonable or plausible changes in the parameters and judgments.

The Board has emphasized the desirability of conducting a probabilistic "performance assessment" using quantitative models as a means of integrating and weighting the post-closure factors at each site.

The Board noted that the expected total repository and transportation costs would have a major, if not controlling, effect on the rankings under pre-closure factors. This recognition reinforced the Board's judgment that the principal usefulness of the multi-attribute utility method is to illuminate the factors involved in a decision, rather than to make the decision itself.

Finally, the Board recognized that there are factors other than the multi-attribute decision analyses to be taken into account in the final decision to select three sites for characterization. These include the diversity of rock types required by the Nuclear Waste Policy Act of 1982, judgments about the ability to license a site successfully, including consideration of waste package performance and judgments about the best set of sites to choose to assure the highest likelihood of a licensable site emerging from the characterization process.

Since our letter of April 10, 1986, the DOE has published, in May, 1986, a Multiattribute Utility Analysis of Sites Nominated for Characterization for the First

Radioactive-Waste Repository - A Decision-Aiding Methodology (DOE/ RW-0074). In addition, on May 27, 1986, the Secretary of Energy nominated five sites as suitable for characterization and recommended to the President that three of the sites, Yucca Mountain in Nevada, Deaf Smith County in Texas, and Hanford Reservation in Washington, be characterized as candidate sites for the first repository (Recommendation by the Secretary of Energy of Candidate Sites for Site Characterization for the First Radioactive-Waste Repository, DOE/ S-0048, Washington, D.C., 1986). The President approved the Secretary's recommendation on May 28 1986.

On July 25, 1986, the Director of the Office of Civilian Radioactive Waste Management, Mr. Ben C. Rusche, requested that the President of the National Academy of Sciences and Chairman of the National Research Council provide scientific and technical advice during the site characterization phase of the repository program. On August 14, 1986, the Chairman responded favorably to this request. Both letters are included as Appendix 6. To that end, the Board has proposed a draft Statement of Work to the Commission on Physical Sciences, Mathematics and Resources of the National Research Council to establish three multi-disciplinary panels (one for each of the three proposed sites) to review the scientific and technical adequacy of documentation supporting portions of the program for site characterization, performance assessment for the repository and waste packages, and the implementation of the experimental program. The panels will not consider non-technical aspects of site characterization. Their reports will not provide independent verification of the accuracy of raw data, assess overall program adequacy, or evaluate site adequacy for repository use. The proposed draft Statement of Work is attached as Appendix 7.

To make the process of review more transparent and open, and to avoid duplication, we have met twice with the affected states and Indian tribes and with the Nuclear Regulatory Commission to exchange viewpoints. Based upon these meetings and our experience in the continuing review of the Waste Isolation Pilot Plant in New Mexico, we have proposed Draft Operating Procedures for the panels. The Board will provide continuing oversight to each panel, as well as a cross-cutting function between panels. All documents submitted to the panels will have to be available without restriction to other interested parties. The draft operational procedures document is shown in Appendix 8.

The contract to fund the operation of the panels has not yet been negotiated nor have the panels been appointed. Consequently, it is not possible to say precisely how the panels will operate. However, a brief review of our experiences with the WIPP Panel may be illuminating. The WIPP Panel was established in 1978 at the request of the Department of Energy "to review the scientific and technical criteria and guidelines for designing, constructing and operating a Waste Isolation Pilot Plant for isolating radioactive waste from the biosphere." The Panel undertook to "review the scientific and technical adequacy of the site-suitability criteria; the guidelines for the site confirmation studies; the design criteria for the repository, including the waste acceptance criteria, the design philosophy and the operational philosophy; the criteria for determining the environmental safety of future planned operations viewed from the perspective of the environmental conditions of the repository site; and the design criteria for the experimental testing program of the behavior of the waste-geologic medium interaction." The Panel issued a final report, "Review of the Scientific and Technical Criteria for the Waste Isolation Pilot Plant (WIPP)," in 1984 (National Academy Press - DOE/DP/48015-1). The Panel at that time was reconstituted to review the scientific and technical adequacy of the criteria and guidelines for the site suitability, design, construction and operation of the Waste Isolation Pilot Plant with a project period through 1988. The members of the current Panel are listed in Appendix 9.

The initial Panel in its report found that the scientific work had been carried out with a high degree of professional competence and that the geology determined by underground exploration and measurements generally confirmed the geologic expectations derived from surface explorations and boreholes but that some issues about the hydrology and design of the facility should be resolved before large-scale transuranic (TRU) waste emplacement begins. During that study the Panel worked closely with the Department of Energy and its contractors, the State of New Mexico and the City of Carlsbad, and held public meetings to elicit the views of the scientific and technical critics of the program. The Panel did not deal with packaging of waste at the originating sites, transport to the site, transport vehicles nor the disposal of heat-generating waste. The Panel, composed, as are all Academy panels and boards, of volunteer workers on a part-time basis, benefitted enormously from the work carried out by the Department of Energy and its contractors (particularly the Sandia National Laboratory) and the work and critiques of the State of New Mexico's Environmental Evaluation Group.

Although the report has been acknowledged as a useful compilation of the views of the Panel, both the Department of Energy and the Environmental Evaluation Group of the State of New Mexico felt that the interactions and comments at the meetings and field trips were an extremely helpful aspect of the Panel's work. Perhaps the most important change in policy at the WIPP site and in the U.S. Radioactive Waste Management program resulted from the Panel's call, in a letter report on September 10, 1979, for a shaft to be drilled down to the projected emplacement horizon, with tunnels excavated to carry out tests and observations to resolve remaining site-specific geotechnical uncertainties. It was pointed out that only by this technique could an adequate understanding of subsurface conditions be obtained. Perhaps the usefulness of the Panel can best be inferred by the fact that when the National Research Council was deliberating whether to reconstitute the Panel for an additional four years, both the Department of Energy and the State of New Mexico sent letters to the Council urging them to continue the overview of the WIPP project.

The Board expects its panels to follow procedures similar to those of the WIPP Panel in the oversight of the three proposed sites for characterization for the nation's first high-level waste repository. At present the proposal for the establishment of the three panels is in the Research Council's internal approval cycle. When approved it will be delivered to the DOE and further progress will be coupled to their procurement process.

On behalf of the Board of Radioactive Waste Management of the National Research Council (members of which are listed in Appendix 10). I want to thank you for the opportunity to appear here today. If you have any questions, I shall be pleased to try to answer them.

APPENDIX 1

NATIONAL RESEARCH COUNCIL
COMMISSION ON PHYSICAL SCIENCES MATHEMATICS AND RESOURCES
2101 Constitution Avenue Washington D.C. 20418

BOARD ON
RADIOACTIVE WASTE MANAGEMENT
(202) 334-3066

OFFICE LOCATION
JOSEPH HENRY BUILDING
21ST STREET AND
PENNSYLVANIA AVENUE N.W.

April 26, 1985

Mr. Ben Rusche, Director
Office of Civilian
  Radioactive Waste Management
RW-1/Forrestal
U.S. Department of Energy
Washington, D.C. 20585

Dear Mr. Rusche:

The Board on Radioactive Waste Management has reviewed Chapter 7 of the Draft Environmental Assessments (DEA's) that were issued in December 1984 by the Department of Energy (DOE) in response to Section 112 of the Nuclear Waste Policy Act (NWPA) of 1982. The chapter is seen to be particularly important because in it DOE presents a comparative evaluation of the five sites under consideration for site characterization. The characterization step, which will require constructing a shaft and conducting explorations at repository depth, is then proposed for three of the sites -- Deaf Smith, Texas (in bedded salt); Hanford, Washington (in basalt); and Yucca Mountain, Nevada (in tuff) -- which is the minimum number required by the act.

As a preface to its comments, the Board would like to compliment DOE for issuing the Environmental Assessments in draft form for public comment, which is not required by the act. While this letter offers a number of recommendations for possible improvement, the Board recognizes that DOE has had to comply with the final General Guidelines for the Recommendation of Sites (published in the Federal Register in December 1984), and that the decision being addressed by the DEA's is strictly on which of the sites to concentrate the necessary further study. The characterization step, which will require spending hundreds of millions of dollars at each site, will clearly provide much more data than is known at present, and ultimately the information on which to base the eventual decision on where to site a repository.

The Board's criticism of the Draft Chapter 7 and Appendix B is focused on three major concerns:

- The methodology of comparative assessment is unsatisfactory, inadequate, undocumented, and biased and should be reconsidered in accordance with the following paragraphs;

- Insufficient weight and attention are placed on the clear need to find a site adequate under the post-closure guidelines before considering its relative rank under pre-closure guidelines; and

- Quite apart from the question of technical acceptability, the presentation of the methodology of comparison is sufficiently important that it should be highlighted as a stand-alone issue separate from the earlier parts of Chapter 7 which speak to site suitability.

The comparison process used by DOE was, first, to rank the five sites for each of the twenty technical guidelines, and then to aggregate the rankings by three simple quantitative methods. The Board does not consider the "averaging method" and the "pair-wise comparison method" to be satisfactory since the spread in rankings is artificially determined. The "utility estimation method," or multiattribute analysis, can be a valid means for comparing sites based on the eleven pre-closure guidelines (which deal with radiological safety; environment, socioeconomics, and transportation; and ease and cost of construction, operation and closure).

However, since multiattribute analysis is a technique that is appropriate and useful only when other analytic comparisons cannot or can no longer be made, the application of this method to the post-closure guidelines is not an adequate means of assessing repository performance. Many of the post-closure factors, such as the ones dealing with geohydrology, geochemistry, rock characteristics, and dissolution, do not act independently in determining performance, and their relative importance is site-specific. The DOE method treats the factors independently and gives them equal weights for all the sites. For the post-closure guidelines, the Board recommends a different method of assessing performance, which does not use multiattribute analysis except as a way to estimate qualitatively the uncertainties.

In carrying out the analysis for both the post-closure and pre-closure factors, it is necessary to make clear how the ratings of the sites for each factor are determined and by whom. The same can be said for the weightings given each factor. A series of expert panels of judges is needed in order to have a measure of the variability of the ratings and weights, which can then be used to assess the stability of the final rankings. The DOE analysis did not make clear who assigned the ratings or the weights. One procedure might be to use the combined group of technical review committees as mentioned in the discussion of post-closure performance assessment below to reassess the ratings for each site for each guideline, as a basis for an evaluation of the sensitivity of the overall rankings to these individual ratings. Finally the Board questions the DOE assumption that lack of information should be equated with unfavorable information in rating a site for a particular factor. For example, the lack of information on the ability of the Department of Energy to acquire the Utah site, which is now owned by the U.S. Government but controlled by the Bureau of Land Management, resulted in the very low ranking on ownership.

Of far greater importance than the premature use of multiattribute analysis, the DOE weighting of the post-closure and pre-closure factors (51:49, respectively) seems to be biased too much towards the latter, and barely in keeping with the requirements of the guidelines. (The Board recognizes that DOE did vary the overall weighting between the sets of pre- and post-closure factors.) The post-closure guidelines are clearly the most important and the adequacy of a site under the post-closure guidelines must be clearly established before attempting comparison with other sites. Deficiencies in the pre-closure factors can be mitigated substantially at increased cost.

The Post-closure comparison methods used by DOE, and quite possibly the method recommended by the Board, do not discriminate significantly among the sites. Consequently, the choice of sites for characterization is driven largely by the variances in the ratings of the pre-closure factors. This very important feature of DOE analysis should be clearly stated in Chapter 7 and highlighted for the reader.

A scientifically defensible method for integrating and properly weighting the post-closure factors at each site is to conduct a "performance assessment", such as was advocated in the Research Council's WISP Report*, using analytic models. With adequate data and confidence in the models, the performance assessments could then be used to compare sites. Even with the current uncertainties and the variability in the quantity and quality of data, performance assessments are still a better means to compare sites for the post-closure guidelines than the method used by DOE. The use of performance assessments is compatible with the system requirements of the final Guidelines, and the Board urges consideration of the methodology advocated in the WISP Report. The Board recognizes, however, that although performance assessments using the current state of knowledge may be able to establish adequacy with respect to post-closure guidelines, they may not be able to discriminate among the five sites assessed to achieve a clear ranking: one site may have lower average releases but a higher variance in the estimate than another site.

Any attempt to rank sites based on the post-closure factors would require a measure of confidence in the magnitude of the uncertainties in the performance assessments. Because the probability distributions for many of the factors that enter the assessments are poorly known at this time, purely analytic methods cannot be used. In this case, multiattribute sensitivity analysis could be used to estimate qualitatively and subjectively the degree of confidence in the performance assessments. For example, the assessments could be used to identify the factors that would appear to be most important for a particular site and the conditions that, if they occur, would compromise performance. A group of experts could then be used to rate and rank the sites based on their current degree of confidence (in terms of an estimated probability) that the unfavorable conditions will not occur and that the repository performance will be better than a specified level. This comparison method will subjectively take into account the different quantities and qualities of data at the sites and the uncertainties in modeling, and it will focus attention on the most serious potential problems as well as the most favorable characteristics for each site. The sites could also be rated and ranked on the basis of an expert group's assessment of the likelihood that characterization will satisfactorily resolve outstanding issues and uncertainties to the degree required for licensing by the Nuclear Regulatory Commission.

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*Waste Isolation Systems Panel, Board on Radioactive Waste Management, Commission on Physical Sciences, Mathematics, and Resources, National Research Council "A Study of the Isolation System for Geologic Disposal of Radioactive Wastes" National Academy Press, Washington DC 1983. See Chapter 9.

If DOE should wish to use this comparison method in the near term, there is a knowledgeable group that could be assembled quickly. The combined group of technical review committees for all of the sites could be brought together and given the tasks outlined above. It would be instructive to see how much agreement (and variability) would emerge when this group attempted to assign a degree of confidence to each of the performance assessments.

More generally, the Board believes that pooled judgement by knowledgeable experts is an appropriate means to assess uncertain and incomplete technical information. The fragile character of these peer judgements is reflected in the fact that how one poses the questions to be answered can affect the outcome. The Board has no expertise to offer on the cognitive psychology of eliciting peer judgements, but it does seem clear that both the range of uncertainty in data and the uncertainties in the models that analyze those data should be assessed.

The Board recommends that great emphasis be placed on learning from each step throughout the multi-year process of developing a repository. The characterization of several sites at repository depth is now needed for this learning process to continue. A question arises as to the best and most robust strategy if one or more sites should fall by the wayside during the characterization process. Clearly, if it were determined that three sites must be qualified after characterization in order to submit a license application to the NRC, then it would be prudent to characterize more than three sites. It is extremely important, therefore, for this issue to be resolved quickly. Even if three qualified sites are not required, the Board believes it is technically desirable and important to consider additional exploration at the two sites not currently recommended for characterization, although this may be difficult under the provisions of the Nuclear Waste Policy Act.

The Board's third major concern after pointing out the flaws in the method and the lack of emphasis on adequate site as against best site, is with the presentation of the method of comparison of the sites. Chapter 7 and Appendix B explain the method of selection of sites for characterization, but neither does that job adequately. The methodology of comparison (now Section 7.4) should, after revision, be given a position of greater emphasis by withdrawing it from Chapter 7 and making it a stand-alone issue. The most important points in the present methodology, such as the fact that the pre-closure ratings largely determine the final rankings, are not clearly and crisply stated. Critical information, such as the ratings given sites for various factors (Tables B-2 and B-3), should not be buried in an appendix. Explanations can be clear even when the comparison process is complicated.

The Board appreciates the difficulties involved in drafting Environmental Assessments and making a selection at this stage of the data collection and further appreciates the opportunity to comment on the Environmental Assessments. We wish you well in your task of making the necessary major revision, and would be pleased to amplify any of the points raised in this letter or in our recent meeting with OCRWM staff.

Sincerely,

Frank L. Parker

Frank L. Parker
Chairman

FLP:jc

APPENDIX 2

Department of Energy
Washington, DC 20585

AUG 29 1985

Dr. Frank Parker
Vanderbilt University
P.O. Box 1596, Station B
Nashville, Tennessee 37235

Dear Dr. Parker:

This is in reference to your telephone conversation with Tom Isaacs of my office on August 5, 1985, regarding the possibility of the National Academy of Sciences'(NAS) Board on Radioactive Waste Management conducting an independent review of the methodology to be used to evaluate sites for consideration as candidate sites for characterization for the first geologic radioactive waste repository. We would like to request the Board's review consistent with the scope and schedule described below.

As outlined in the Department's siting guidelines for nuclear waste repositories (10CFR960), "[o]n the basis of the siting provisions specifying the basis for site evaluations in 960.3-1-5, the sites nominated as suitable for characterization shall be considered as to their order of preference as candidate sites for characterization" (§960.3-2-3). In the draft Environmental Assessments issued in December 1984, the Department included in section 7.4 of Chapter 7 a proposed order of preference of the proposed nominated sites based in part on several ways of combining site rankings under the individual guidelines. We have received a number of comments, including those of the Board, on the rankings and the methodology used in the draft EAs. In light of these comments and the concerns expressed by the States, the Department is reexamining the methodology used in the draft EAs to consider appropriate changes for the final EAs. Such a reexamination is now in progress. We believe that an independent review of ranking methodology by an organization such as the NAS Board would be useful in assuring an effective and credible document.

It is our understanding that the NAS Board on Radioactive Waste Management is willing to perform an independent review of the adequacy of a ranking methodology to be used in the final EAs scheduled for publication in December 1985. The Department would intend to append your review findings to the final EAs and to the Secretary's nomination and recommendation to the President. We can provide you with a copy of the ranking methodology to support development of the preferred order of sites at least two weeks prior to the next scheduled meeting of the Board on October 1-3, 1985. For the review findings to be appended to the EAs, we would need to receive the Board's letter report or other appropriate document by November 15, 1985.

We look forward to your reply. Should you accept our request for this important review of the ranking methodology on behalf of the NAS, please contact Tom Isaacs or me so that we may arrange to provide you with all the pertinent information in a timely fashion.

Sincerely,

Ben C. Rusche

Ben C. Rusche, Director
Office of Civilian Radioactive
Waste Management

cc: Peter Myers
National Academy of Sciences

APPENDIX 3

NATIONAL RESEARCH COUNCIL
COMMISSION ON PHYSICAL SCIENCES, MATHEMATICS, AND RESOURCES
2101 Constitution Avenue Washington, D.C. 20418

BOARD ON
RADIOACTIVE WASTE MANAGEMENT
[illegible]

OFFICE LOCATION
JOSEPH HENRY BUILDING
21ST STREET AND
PENNSYLVANIA AVENUE, N.W.

October 10, 1985

Mr. Ben C. Rusche, Director, OCRWM
U.S. Department of Energy
RW-1/Forrestal
Washington, D.C. 20585

Dear Mr. Rusche:

In response to your August 29, 1985 request that the Research Council's Board on Radioactive Waste Management conduct "an independent review of the methodology to be used to evaluate sites for consideration as candidate sites for characterization for the first geologic radioactive waste repository", the Board has reviewed the Department of Energy's (DOE) August 1985 document "A Methodology for Aiding Repository Siting Decisions." The document describes work in progress on the application of the multiattribute utility technique to help the Secretary of Energy select three sites to recommend to the President for characterization as candidate sites for a repository for permanent deep geologic disposal of high level radioactive waste as required by the Nuclear Waste Policy Act (Sec 112 (b) (1) (B)).

The Department of Energy's August methodology paper presents only the basic concepts of the multiattribute utility technique, together with a few simplified illustrative examples. Consequently, it is important to note that, except for some of those involved in multiattribute utility technique itself, the Board on Radioactive Waste Management did not have an opportunity to consider matters of technical substance, such as site-specific data or revisions to the draft Environmental Assessments. Further, since it was not contained in the methodology document, the Board was not able to examine the specific implementation of the multiattribute utility technique being developed by DOE (including performance measure scales, scoring procedures and associated probability distributions, influence diagrams, utility functions, weighting factors, and procedures for selecting panels of technical experts and DOE decision makers).

Nevertheless, the Board commends DOE for its adoption of a rigorous form of this decision-aiding methodology. While recognizing that there is no unique procedure for ranking, the Board believes that the multiattribute utility technique can be an appropriate method by which to integrate technical, economic, environmental, socioeconomic, and health and safety issues to assist DOE in its selection of sites for characterization. Thus we feel that our concern about the appropriateness of the methodology, as expressed in our April 26, 1985 critique of Chapter 7 of the December 1984 Draft Environmental Assessments, has now been addressed.

Although the multiattribute utility technique proposed by DOE appears appropriate, the technique must be implemented correctly and accurately to be useful and credible. The adequacy of the application of the technique can only be evaluated after the analysis is complete. In the absence of documentation on how the multiattribute utility technique is being applied by DOE we cannot now determine the extent to which our earlier concerns will be answered about the adequacy of site rankings, the appropriateness of documentation supporting and describing the results, and the potential for bias in applying the technique.

The multiattribute utility technique appears to be a promising approach for stating clearly and systematically the assumptions, judgments, preferences, and tradeoffs that must go into a siting decision. As explained in the Board's letter of April 26, 1985, the "utility estimation" technique used in Chapter 7 of the Draft Environmental Assessments was not adequate, because it treated post-closure factors independently and gave them equal weight for all sites. The Board reiterates that a scientifically defensible method of integrating and weighting the post-closure factors at each site is to conduct a "performance assessment" using quantitative models, as recommended in the National Research Council's report on the Waste Isolation Systems Project.

Were adequate data and validated models available, the results of the performance assessments could provide a direct estimate of post-closure performance, which could be integrated with pre-closure factors by using a multiattribute utility technique analysis to compare sites. When currently available performance assessments are not adequate for reliable direct comparison of the expected post-closure performance of the five sites, judgments of experts may be used to develop subjective estimates of the performance of the post-closure factors at each site. DOE has proposed that its technical experts and those of its contractors use this approach to develop performance measure scales and to score each site on those scales. The Board is concerned that DOE's use of its own technical experts to assess performance by this subjective method may mask the degree of real uncertainty associated with post-closure issues.

The Board believes that particular emphasis must be placed on the analysis and comparison of the post-closure performance of the sites in order to test the validity of the conclusion in the Draft Environmental Assessments that the five sites are essentially indistinguishable with respect to the post-closure measures. The credibility of those estimates would be substantially enhanced if an independent panel of outside experts were to review the complete analysis prior to issuance of the final Environmental Assessments.

DOE proposes to use multiattribute utility technique as a decision-aiding rather than decision-making technique. The Board on Radioactive Waste Management supports this limited approach. As stated in our letters of April 2, 1984 to DOE and the U.S. Nuclear Regulatory Commission, "The combination of complexity and uncertainty [in the repository siting problem] implies that DOE must be accorded substantial discretion to exercise its best technical judgment in recommending three of the nominated sites according to Sec. 112 (b) (1) (B)." Proper implementation of the multiattribute utility technique would illuminate DOE's decision process by presenting a comprehensive and explicit specification of the assumptions, value judgments, and technical estimates used in ranking the sites.

The comprehensive, explicit disclosure made possible by the multiattribute utility technique is both a strength and a weakness. Its strength is that it documents a difficult and controversial decision. Its weakness is that the documentation itself will be, of necessity, complex, lengthy, and burdened with concepts that are themselves formidably technical and hard to explain.

The complexity of the multiattribute utility technique demands scrupulous, methodical implementation, and it is crucial that DOE take time to do the job right. More time than is currently planned by DOE to complete the Environmental Assessments may well be needed, but the importance of the decision on site characterization to the implementation of the Nuclear Waste Policy Act as a whole strongly supports the wisdom of a careful, comprehensive application of the technique. A prompt decision now by DOE to take additional time would also permit internal and external review of the key technical components of the multiattribute utility technique.

A potential difficulty is that the siting guidelines specify a hierarchy of importance between the pre- and post-closure groups of factors and among the three groups of pre-closure factors. While the general intent of specifying an order of priority is clear, there remains the possibility that translating a vaguely worded requirement into precise mathematical constraints on the numerical weights estimated as part of the multiattribute utility technique (as proposed by DOE) may lead to implicit value judgments that DOE is not prepared to defend. An early concern of the analysis should be to determine whether or not this is in fact the case.

The Board recommends that the methodology and assessment portion of Chapter 7, because of its importance in site ranking, be written so that it can stand alone with an introduction that puts the candidate site selection process in perspective. The Board also urges that the theory, data, and methods used in the site recommendation process be presented clearly and understandably so that all uncertainties and judgments are made explicit. The Board recognizes that a major advantage of the multiattribute utility technique approach is that it can facilitate such a presentation.

The Board appreciates the difficulty faced by DOE in responding to all the comments on the Draft Environmental Assessments, in revising the assessments, and in applying a more refined technique to help select the three candidate sites. We compliment DOE on the way in which they have responded with a revised methodology to our concerns and those of others about the Draft

Environmental Assessments. The Board supports the rigorous application of the new methodology and would be pleased to amplify any of the points raised in this letter or in our meeting of October 1-3, 1985 with the staff of the Office of Civilian Radioactive Waste Management.

Sincerely,

Frank L. Parker

Frank L. Parker
Chairman
Board on Radioactive
 Waste Management

FLP/jc

APPENDIX 4

Department of Energy
Washington, DC 20585

OCT 30 1985

Dr. Frank Press
President
National Academy of Sciences
2101 Constitution Ave., NW
Washington, DC 20418

Dear Dr. Press:

As you are aware the Department of Energy has the principal responsibility for implementing the Nuclear Waste Policy Act to site, construct, operate and decommission the nation's first repository for the permanent disposal of high-level radioactive waste. In carrying out the program, the Academy's Board on Radioactive Waste Management has provided valuable analytical reviews of key program activities.

In particular, we recently received the letter report from the Board, in response to our request that they undertake a review of the methodology we proposed for aiding the selection of sites to be characterized. We were pleased that the Board concluded that the multiattribute utility technique which we proposed is an appropriate tool if implemented correctly. We are also grateful for the unusually prompt response which, I believe, reflects both the importance of the program and the dedication of the Board and the Academy.

The report of the Board also described several recommendations for DOE to consider in applying the methodology. One of the Board's recommendations is that an independent panel of outside experts conduct a comprehensive review of the analysis. We agree. In reviewing this recommendation, we believe the Board is the best qualified group to undertake this review in a timely manner. Therefore, I ask that you approve the Board undertaking this independent review of our application of the methodology, to provide an additional assurance that we have applied the methodology in an appropriate and reasonable way. We have agreed with the Board in past conversations that it is not appropriate to ask the Board to validate, agree with, or defend the technical data that serve as inputs to the methodology.

If you approve this task, we will work with your staff, to develop a mutually convenient schedule for the Board's further involvement. We look forward to your reply.

Sincerely,

Ben C. Rusche

Ben C. Rusche, Director
Office of Civilian Radioactive
Waste Management

cc: Peter Myers, Staff Director
Board on Radioactive Waste Management
National Academy of Sciences

Dr. Frank Parker, Chairman
Board on Radioactive Waste Management
National Academy of Sciences

APPENDIX 5

NATIONAL RESEARCH COUNCIL
COMMISSION ON PHYSICAL SCIENCES, MATHEMATICS, AND RESOURCES
2101 Constitution Avenue, Washington, D.C. 20418

BOARD ON
RADIOACTIVE WASTE MANAGEMENT
[illegible]

OFFICE LOCATION
JOSEPH HENRY BUILDING
21ST STREET AND
PENNSYLVANIA AVENUE, N.W.

April 10, 1986

Mr. Ben C. Rusche, Director OCRWM
U.S. Department of Energy
RW-1/Forrestal
Washington, D.C. 20585

Dear Mr. Rusche:

In response to your August 29, 1985, request that the National Research Council's Board on Radioactive Waste Management (Board) conduct "an independent review of the methodology to be used to evaluate sites for consideration as candidate sites for characterization for the first geologic repository," and your October 30, 1985, specific request that we further undertake an "independent review of [the] application of the methodology," the Board has reviewed portions of the Department of Energy's (DOE or Department) March 17, 1986, draft of the final Candidate Site Recommendation Report (CSRR). The Board has previously provided DOE with comments on the Department's original draft methodology by its letter of April 26, 1985, and comments on a revised methodological approach by its letter of October 10, 1985.

It is neither appropriate nor the intent of the Board to address the ultimate ranking or the recommendation of specific sites, both of which go beyond the implementation of the decision-aiding methodology. Accordingly, the chapters and appendices reviewed by the Board and its consultants were limited to an overview of the decision-aiding methodology, its application to post-closure factors for all five candidate sites, and its application to pre-closure factors at one site. The Board chose not to review, and at its own request did not have access to, DOE's rankings on pre-closure factors, rankings combining post-closure and pre-closure factors using the decision-aiding methodology, or the final recommendation of sites for characterization. Because of the limits on available time and the volume of the documentation involved, the Board did not attempt to review the site-specific data in the draft Environmental Assessments (EAs). To help conduct this review, the Board enlisted the aid of four consultants, three of whom are recognized experts in multi-attribute utility analysis and its applications.

I. THE DECISION-AIDING METHODOLOGY

The Board commends DOE for the high quality of the chapters that were reviewed. The use of the multi-attribute utility method is appropriate, and the Board is impressed by the care and attention to detail with which it has been implemented. It should be noted, however, that the Board's focus was on methodology and its implementation and that the Board has not reviewed in detail the data and judgments on which the conclusions from the multi-attribute procedure are based.

While recognizing that there is no single, generally accepted procedure for integrating technical, economic, environmental, socioeconomic, and health and safety issues for ranking sites, the Board believes that the multi-attribute utility method used by DOE is a satisfactory and appropriate decision-aiding tool. The multi-attribute utility method is a useful approach for stating clearly and systematically the assumptions, judgments, preferences, and tradeoffs that must go into a siting decision. The Board strongly supports the DOE position that the methodology is best applied only as a decision-aiding tool and that additional factors and judgments are required to make final decisions about which sites to characterize. These include the diversity of rock types required by the Nuclear Waste Policy Act of 1982, judgments about the ability to license successfully a site including considerations of waste package performance, and judgments about the best set of sites to choose to assure the highest likelihood of a licensable site emerging from the characterization process.

The Board is disappointed that DOE did not follow the recommendation, made in the Board's April 26 and October 10 letters, that independent experts be brought into the assessment process itself as well as into the review of the process. As noted in the October letter, "The Board is concerned that DOE's use of its own technical experts to assess performance by this subjective method may mask the degree of real uncertainty associated with post-closure issues." The Board has seen nothing to indicate bias in the implementation of the method and recognizes that, in this instance, the DOE sensitivity analysis applied to post-closure issues indicates that the rankings on these issues would not change with reasonable or plausible changes in the parameters and judgments. In other applications of the methodology, however, the results may not be so insensitive to the judgments. In that event the addition of independent experts in the generation of those judgments would be important. A final concern with the review draft remains: the need for additional documentation beyond that included in the March 17, 1986, draft of the reasoning and judgement involved in the choices of the scores and probabilities associated with the various scenarios. On the basis of discussions with DOE staff, the Board anticipates a satisfactory response to this concern in the final version of the CSRR.

II. POST-CLOSURE ANALYSES

The DOE application of the multi-attribute utility method for the post-closure factors provides useful information concerning the Department's current judgment of the expected performance of the sites for the post-closure period and on its judgment of the range of uncertainties. The Board reiterates that, when adequate data and validated models are available, conducting a probabilistic "performance assessment" using quantitative models, as recommended by the National Research Council[1], is a scientifically defensible method of integrating and weighting the post-closure factors at each site. In the absence of performance assessments capable of comparing the expected post-closure performance of the sites directly, judgments of experts are appropriately used to develop subjective estimates of the post-closure factors at each site. DOE has implemented this approach using its technical experts and those of its contractors, and it appears to have incorporated information resulting from models on the release and migration of radionuclides to the "accessible environment" (as defined by the Environmental Protection Agency (EPA)). The Department has also conducted an extensive sensitivity analysis.

The DOE analysis assesses post-closure performance based on probabilities of releases to an arbitrarily defined and universally applied accessible environment. This approach is consistent with the DOE siting guidelines and follows the requirements for repository performance established in the EPA Standard (40 CFR 191). Because this approach does not take into account the differences among sites in pathways from the EPA accessible environment to the biosphere, and thus the potential consequences of any given release at the accessible environment, the Board recommends that the DOE decision makers consider such differences in addition to the results of the decision-aiding methodology. Chapter 6, which the Board has been told considers decision factors beyond the scope of the multi-attribute utility method, would seem to be the appropriate place to incorporate such consideration for the present decision. If the multi-attribute utility method is applied to a future site selection process, however, the evaluation of relative environmental consequences should become part of the post-closure analysis. Such an approach would facilitate comparison of post- and pre-closure results.

III. PRE-CLOSURE ANALYSES

The pre-closure results are stated in terms of dollar costs, estimated lives lost in building and operating a repository, and performance measures covering esthetic, archeological, biological and socioeconomic impacts. Although the multi-attribute utility method significantly clarifies the relative importance of the many factors considered in ranking sites, the reduction of all attributes to a single quantitative scale depends, in this application, upon the value tradeoffs made by DOE staff. In addition to the sensitivity analysis they conducted, the Department decision makers might have found it beneficial in the selection of objectives and in weighing pre-closure factors to draw on value judgments from a variety of sources outside the DOE.

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[1] National Research Council 1983. A Study of the Isolation System for Geologic Disposal of Radioactive Wastes. Board on Radioactive Waste Management, Panel on Waste Isolation Systems. National Academy Press, Washington, D.C.

On the basis of the Board's review of the application to a single site, it appears that the expected total repository and transportation costs will have a major, if not controlling, effect on the rankings under pre-closure factors. This recognition of the heavy dependence on cost reinforces the Board's judgment that the principal usefulness of the multi-attribute utility method is to illuminate the factors involved in a decision, rather than to make the decision itself.

IV. CONCLUSIONS

In addition to the multi-attribute decision analysis, there are other factors that must be taken into account in the final decision to select three sites for characterization. These include the diversity of rock types required by the Nuclear Waste Policy Act of 1982, judgments about the ability to license successfully a site including considerations of waste package performance, and judgments about the best set of sites to choose to assure the highest likelihood of a licensable site emerging from the characterization process.

When the Board commented on the Draft Environmental Assessments a year ago, it expressed strong reservations about the methods used by DOE to select sites for characterization. The Department has made substantial progress since then. As stated in the Board's October 10, 1985, report, "...our concern about the appropriateness of the methodology, as expressed in our April 26, 1985, critique of Chapter 7 of the December, 1984, Draft Environmental Assessments, has now been addressed." DOE has now selected a decision-aiding method that the Board believes is appropriate to the complexity and technical uncertainties of the decision the Department faces in choosing sites to characterize.

Although the Board has not seen the final version of the CSRR, those parts of the draft it has reviewed include substantial documentation of the site-ranking method and the way it has been implemented. On the basis of discussions with DOE staff, we anticipate satisfactory responses to our remaining concerns about documentation in the final CSRR.

In its review of the implementation of the site-ranking methodology, then, the Board finds much to praise. It is important to note that the Board reviewed neither the data in the draft EAs nor the application of the procedures in which sites were scored and value tradeoffs were assessed. Moreover, DOE did not take the Board's advice, offered twice in writing, to involve outside groups of experts in the site-ranking process beyond this review of the implementation of the methodology by the Board. The Board has seen nothing to indicate bias in the Department's implementation of the methodology and recognizes the value of the DOE sensitivity analysis, but the lack of external input in technical and value judgments could raise concerns about bias.

Despite the limitations in the scope of the Board's review, we believe the methods used in the CSRR provide a sound analytical basis for aiding the site characterization decision. The Board commends the Department of Energy for taking the time and devoting the resources to identify and apply a comprehensive decision-aiding methodology. We believe that the methodology the Department has selected represents "state of the art" and is adequate and appropriate for this purpose. We compliment DOE on its care and diligence in implementing the site-ranking methodology, and encourage the Department to build on the experience it has gained as it continues the search for a geologic repository.

Sincerely,

Frank L Parker

Frank L. Parker
Chairman, Board on
Radioactive Waste Management

FLP:jc

COMMISSION ON PHYSICAL SCIENCES, MATHEMATICS AND RESOURCES

BOARD ON RADIOACTIVE WASTE MANAGEMENT

MEMBERSHIP

Frank L. Parker, CHAIRMAN
Department of Environmental Engineering
Vanderbilt University
(civil and environmental engineering)

Clarence R. Allen, California Institute of Technology, (geology, seismology)
E. William Colglazier, University of Tennessee (physics, engineering risk analysis)
John W. Healy, Consultant (chemical engineering, health physics)
G. Ross Heath, University of Washington, (oceanography, marine geology)
Kai N. Lee, University of Washington, (political science, policy analysis)
Robert B. Lyon, Whiteshell Nuclear Research Establishment (nuclear chemical engineering)
Frederick T. Mackenzie, University of Hawaii (geology, geochemistry)
John M. Matuszek,Jr., New York State Department of Health (health physics, nuclear chemistry)
Chris G. Whipple, Electric Power Research Institute (risk analysis, energy economics)
Susan Wiltshire, JK Associates, (public policy)

CONSULTANTS

David Bell, Harvard Business School (decision analysis)
Thomas Cotton, Office of Technology Assessment (now with JK Associates) (public policy, systems analysis)
D. Warner North, Decision Focus, Incorporated (decision analysis)
Detlof von Winterfeldt, University of Southern California (decision analysis)

APPENDIX 6

Department of Energy
Washington, DC 20585

JUL 25 1986

Frank Press, Ph.D
President
National Academy of Sciences
2101 Constitution Ave., N.W.
Washington, D.C. 20418

Dear Dr. Press:

On May 28, 1986, President Reagan approved the Department of Energy (DOE) recommendation of sites in Texas, Nevada, and Washington to be characterized as part of the program to site the Nation's first high-level radioactive waste repository. As you are aware, the National Academy of Sciences (NAS) Board on Radioactive Waste Management conducted an independent review of the methodology used to aid the recommendation decision as well as the application of that methodology. The suggestions and conclusions of the Board in the review process proved to be of significant value to the program and the general endorsement of our use of the methodology provided added confidence in our process.

With the President's approval of our recommendation, the nature of first repository program activities will shift substantially and now focus for the next several years on characterization of the three sites to determine the final suitability and preference of those candidate sites for repository development. Preliminary discussions with Board members and staff have identified significant benefits of continued Board oversight of activities during this next important site characterization phase in the repository program. They have also identified the desirability to have the Board and the Academy review the proper scope and content of future Board involvement with particular emphasis given to site-specific and comparative evaluations through the establishment of suitably constituted panels of the Board.

DOE recognizes and endorses the need for the Academy to have autonomy in formulating the nature of its participation. We believe that the recent discussions can form the basis for an effective future Academy role. Given current activities such as development of site characterization plans and implementation of the quality assurance program, timely Board participation will be of substantial value. We are prepared to work with the Academy and its Board in further refining its role, and look forward to receiving a positive indication of continuing Academy involvement and your views on these relationships.

Sincerely,

Ben C Rusche

Ben C. Rusche, Director
Office of Civilian Radioactive
Waste Management

APPENDIX 6

NATIONAL RESEARCH COUNCIL
2101 CONSTITUTION AVENUE WASHINGTON D C 20418

OFFICE OF THE CHAIRMAN

August 14, 1986

Ben C. Rusche
Director, Office of Civilian
  Radioactive Waste Management
Department of Energy
Mail Stop GB-270
Washington, DC 20585

Dear Ben:

Your recent letter requesting assistance from the National Research Council in the site characterization phase of the repository program suggests continuation of what has become a substantial and effective interaction between the Research Council and the Department of Energy. These are important national issues of just the sort that the Research Council was established to consider.

The National Research Council can and will provide the advice you seek. I have asked Dr. Peter Myers, Staff Director of our Board on Radioactive Waste Management, to work with your staff to propose next steps that will enable the Board to respond positively to your request.

Yours sincerely,

Original signed by
Frank Press

Frank Press
Chairman

RK/FP/bh
✓bcc: Peter Myers

THE NATIONAL RESEARCH COUNCIL IS THE PRINCIPAL OPERATING AGENCY OF THE NATIONAL ACADEMY OF SCIENCES AND THE NATIONAL ACADEMY OF ENGINEERING
TO SERVE GOVERNMENT AND OTHER ORGANIZATIONS

APPENDIX 7

PROPOSED STATEMENT OF WORK

The general objective of this study is to conduct a continuing independent technical review and evaluation of certain portions, selected by the National Research Council, of the U. S. Department of Energy's program for the characterization of each of three candidate sites preliminary to the selection of one to be the first geologic repository for high level radioactive waste. The National Research Council, through its Board on Radioactive Waste Management, will conduct the study as follows:

1. *The Chairman - National Research Council, upon recommendation from the Commission on Physical Sciences, Mathematics and Resources and its Board on Radioactive Waste Management (BRWM) will appoint three multidisciplinary panels of approximately twelve experts each in such fields as geological sciences, including rock mechanics, geochemistry and hydrology; environmental science; socio-economic sciences; radiobiology and health physics; public policy, including law and regulatory practices; systems analysis; and repository engineering (e.g., considerations of corrosion, chemical engineering, and thermo-hydraulic engineering).*
2. *The panel for each site will review the scientific and technical adequacy of documentation supporting portions of:*
   - a. *the program for site characterization including assessment of key elements of DOE's scientific analysis--particularly the identification of critical uncertainties and limitations in the analytic framework;*
   - b. *the performance assessment for the repository and the waste packages including, where necessary, appraisal of the scope and quality of technical judgments leading to major technical decisions;*
   - c. *the implementation of the experimental program and subsequent analysis including identification of important scientific and technical issues that deserve greater attention.*

During the site characterization phase of the Radioactive Waste Repository Program, significant detailed scientific and technical questions associated with the candidate repository sites may arise. When comment from the National Research Council may be helpful, and is both within the competence of the assembled study group and appropriate for study and review by the Research Council, the panels will consider addressing such questions.

3. Reports including conclusions and recommendations will be prepared by the panels, reviewed in accordance with standing Academy procedures, and reproduced in sufficient quantity to ensure distribution to the sponsor, to committee members, and to other relevant parties in accordance with Academy policy. The reports will be made available to the public without restriction.

APPENDIX 8

DRAFT OPERATING PROCEDURES

The following statements are indicative of the operating procedures the Board intends to set up for the site characterization panels requested by the Department of Energy

1. *The Chairman of the National Research Council (NRC) has agreed to a request by the Director of the Department of Energy's (DOE) Office of Civilian Radioactive Waste Management for scientific and technical advice during the site characterization phase of the national geological repository program.*

2. *Upon negotiation of an appropriate agreement, the NRC is prepared to establish three separate panels, one for each site to be characterized, to review the technical bases for portions of the DOE characterization programs.*

3. *The role of each panel will be to evaluate key technical aspects of the DOE site characterization program for completeness and accuracy, and to provide a mechanism by which valid technical concerns from outside the DOE program can be given appropriate and timely consideration.*

4. *Three panels, one for each site to be characterized, will be established with members selected in accordance with current NAS/NRC procedures and appointed for an initial term of three years. Although there will generally be separate members for each panel, some members may serve on more than one panel where the material under review is similar.*

5. *The Board on Radioactive Waste Management (BRWM) will provide continuing oversight to each panel as well as a cross-cutting function between panels.*

6. *Meetings will generally be held at the sites being characterized or in Washington D.C., and their frequency will depend upon the rate at which technical material of interest to each panel is generated.*

7. *Advance notice of each meeting, with a preliminary agenda and an invitation to attend, will be sent to the designated technical representative of each affected State and Indian tribe.*

8. *It is intended that the first meeting of each panel and, as deemed desirable, subsequent meetings from time to time will be held in conjunction with a meeting of the Board on Radioactive Waste Management, and that public attendance will be encouraged during the open portion of the meetings.*

9. *Subsequent panel meetings will usually include both open and executive sessions. The open sessions may consist of technical presentations by DOE, DOE contractors, panel consultants, or invited guests having technical information to present and, consistent with space limitations, will be open to interested observers. Any document submitted as input to a panel will be accepted and considered only if the supplier of the document is willing to make it available without restriction to other interested parties. The executive sessions will be restricted to panel members, members of the Board on Radioactive Waste Management, and Research Council consultants and staff.*

10. *Invited guests will be scheduled on the agenda at the discretion of the Chairman on specific topics of concern to panel members or, failing such specific scheduling, will be given an opportunity to make brief technical remarks to the panel at each meeting. If an invited guest desires more of the panel's consideration than the brief remark period will permit, he or she should submit the concern, in writing, to the panel staff at least two weeks prior to the meeting.*

11. *The panels are not intended to provide fora for polemics, nor can they redress wrongs, real or imaginary. Panel chairmen will, therefore, limit both presentations to the panels and the work of the panel members to technical matters. Panels will, however, seek written comment on technical matters from, and will strive to maintain active contact with and*

participation of. the technical representative or review organization set up by each first round repository State or Indian tribe. Invited technical representatives will be encouraged to participate in all open sessions of the panels. to comment on materials presented to the panels. and to provide written and oral comments on panel reports once they are reviewed in the Academy's normal procedure and released to the public.

12. Interested parties. other than invited guests of a panel. will be admitted to the open sessions as observers on a first-come-first-served basis limited by the capacity of the meeting room. Observers may not ask questions or speak or otherwise participate in the meeting and may be asked to leave (on a last in-first out basis) to make room for arriving invited guests.

13. Although the formal product of each panel will be a sequence of written reports. provision will be made in open sessions for panel members to discuss issues and to question informally the invited representatives of DOE. its contractors. and other agencies. organizations or interested parties on technical matters.

14. Panel reports will be prepared from time to time at the panel's initiative and as the panel deems appropriate. The reports will be based upon technical material including documented personal communications provided by DOE or otherwise obtained by the panel. No report will be prepared on material presented to a panel that is not also available to other interested parties upon request. although any such material presented during the open session portion of a panel meeting may be the subject of comment by individual panel members. Panel reports will be reviewed under existing Academy procedures. and prepared in sufficient quantity to ensure their distribution to the sponsor. to committee members. and to other relevant parties in accordance with Academy policy. They will be available to the public without restriction.

15. The results of the panels' efforts are expected to be reports that will assess the technical basis for portions of the DOE Site Characterization Program and. when necessary. indicate a need and rationale to consider

additional factors. The reports will review and should clarify selected important technical aspects underlying the process for characterizing sites, should illuminate residual uncertainties. The reports will not consider non-technical aspects of site characterization. The results will not, however, provide independent verification of the accuracy of raw data, assess overall program adequacy, or evaluate site adequacy for repository use.

APPENDIX 9

NATIONAL ACADEMY OF SCIENCES / NATIONAL RESEARCH COUNCIL

BOARD ON RADIOACTIVE WASTE MANAGEMENT

WASTE ISOLATION PILOT PLANT (WIPP) PANEL

MEMBERSHIP

Konrad B. Krauskopf, Chairman, Stanford University, geology, geochemistry
John O. Blomeke, Oak Ridge National Laboratory, chemical engineering
John D. Bredehoeft, U.S. Geological Survey, hydrology
Karl P. Cohen, Consultant-Palo Alto, California, nuclear science, technology
Fred M. Ernsberger, University of Florida, materials science
Rodney C. Ewing, University of New Mexico, local/regional geology
Charles Fairhurst, University of Minnesota, rock mechanics
William R. Muehlberger, University of Texas-Austin, geochemistry, salt geology
Frank L. Parker, Vanderbilt University, environmental engineering
D'Arcy A. Shock, Consultant-Ponca City, Oklahoma, mining engineering

The **Chairman**. Thank you very much, Dr. Parker.

~~Dr.~~ Parker, in summary is it fair to say that you see no technical reason at the present time why we should not proceed with the characterization of the three sites?

Dr. **Parker**. That is correct, sir.

The **Chairman**. That while there may be ways in which to improve the procedure, and I think the participation in the National Academy of Sciences certainly has and will continue to improve the confidence in those procedures, that those procedures have been adequately followed up to this point consistent with the Act and consistent with public safety to proceed with the implementation of the Act?

Dr. **Parker**. That is our opinion, sir.

The **Chairman**. Now, Dr. Parker, on another matter, there are at the Nevada test site some 550 to 600 holes where they have had test explosions down there, nuclear explosions which have left some nuclear waste.

Would you tell me what the difference is in the problem of containing those wastes there and the building of a nuclear waste repository?

Dr. **Parker**. As you know, the Board has not looked at that. I can give you my personal view.

The **Chairman**. That is what I am asking for.

Dr. **Parker**. Obviously, those are not contained in any fashion similar to the way the waste would be contained in a nuclear waste repository. They were done underground. As you also know, some of them have vented through the atmosphere. They do not have any metallic cover to restrain those wastes, whereas in the repository this would be a highly engineered facility.

There will be a very thorough investigation of the geological and technological conditions at that site. There will be risk assessments and a probablistic analysis made of what the fate of those materials will be.

The **Chairman**. Well, what would you say would be the greater risk, having 550 to 600 places where we have had nuclear explosions or to have nuclear waste repositories?

Dr. **Parker**. Obviously, material that is not confined, that is open to the elements that could be relatively easily reached is a less safe configuration than those in a repository.

I have not investigated the adequacy of the containment that presently exists to see how much of a threat, if any, it does present. So I cannot speak on absolute terms, but comparatively there is no question that a repository would be far safer than the present configuration.

The **Chairman**. So what you are saying is that you do not know whether or not that is a risk. You are not prepared to say that those 550 to 600 test holes are a risk, but whatever the risk is, it is infinitely greater than having a repository in your state; is that correct?

Dr. **Parker**. That is correct.

The **Chairman**. All right, now that answers that.

Now, can you comment on this question of cost? You have been here this morning. Of all the conclusions we made in Europe, that was one of the clearest, that we are just spending more than we need to.

Can you give an explanation of why we are spending so much more?

Dr. **Parker**. Mr. Chairman, fortunately I have had the opportunity to hear the question earlier, so I have had a chance to think about it. I might also say that I have done two studies for the Swedish government on topics similar to this. As a matter of fact, I brought a draft from the Department of Energy here today. This last one is about 500 or 600 pages.

I believe one of the major reasons which I have not heard discussed here today is similar to the same reason why our reactors are so much more expensive than the Europeans'. Just the time that it takes to do that adds immeasurable cost. Where the French build a reactor in 5 to 6 years, we take 12 years in this country, and the cost of having people on the payroll doing investigation and work over that time adds to the cost enormously. My recollection is something like 50 percent to the cost alone.

I believe other reasons are possibly use of quality assurance in areas where it is not absolutely necessary. If you look at some of the potential backfill materials such as bentonite, our calculations, my calculations, show that it would increase the cost of the bentonite something on the order of tenfold to go through quality assurance.

Now for something similar to a waste disposal site, where the potential for a serious accident is nowhere near as it is in a reactor, whether or not you need the same degree of quality assurance in noncritical areas as you do in a reactor, it seems to me, is not clear at all. I think that that would be a potential saving.

I think also possibly another is that we have a bit more redundancy in our investigative procedures than the Swedes or the French or the Swiss, all the sites I have visited. As a matter of fact, during this work for the Swedish government, I recall the Stripa project, for example. They might have one data logging instrument on site, whereas in some of the sites I have seen in the United States we might have three to do a similar amount of work.

Now, the question of how much backup you need, how much you want, enters into that. I think it is a question of maybe excess redundancy.

The **Chairman**. Dr. Parker, thank you very much.

Senator McClure.

Senator **McClure**. Thank you very much, Mr. Chairman. You have had time to think about another question, too, because it was your testimony I was referring to earlier. [Laughter.]

I note that the language to which I refer which is on page 2 of your statement is identical to language which appeared earlier in the letter to Mr. Ben Rusche dated April 26, 1985. That language to which I refer is that part of your statement which says, "Quite apart from the question of technical acceptability, the presentation of the methodology of comparison", et cetera.

What do you mean by that language?

Dr. **Parker**. Senator McClure, we felt that the issue of how the judgment was made as to which sites had the highest ranking was so important that it ought to be fully elucidated so that any other scientific group looking at it could fully understand exactly how the procedure was done and exactly how the weighting was done, and all the technical information would be readily apparent to other people outside. That is the usual scientific method.

Now, in the draft environmental assessment, that was not the case at all. It was very arcane even to the people who were experts in the field, and we felt that they should have a full exploitation of the methodology.

Senator McClure. Now you raised that question in 1985, almost precisely two years ago, and you raise it again in your statement today. Does that indicate that——

Dr. Parker. No, I am sorry. I do not think I did.

Senator McClure. You did not intend to raise it again?

Dr. Parker. If I did, I am sorry. I did not intend to.

Senator McClure. Then let me ask you this question. Do you believe that has been adequately resolved at this time?

Dr. Parker. Yes. I think the methodology document which the Department of Energy published a short while ago adequately addresses that. It makes it very clear exactly what was done and how it was done, and the advantage of that methodology which we pointed out in our testimony and in our review is that it makes very explicit all of the input material, all the judgments, all the assumptions that were made so that other people who are critics or proponents can look and see exactly what was done. They may not agree with it, but at least it is clear to them what was done. I think that has been very adequately addressed.

Senator McClure. You have used two different terms. One is "independent technical review and evaluation", and the other is "independent verification". You have used those terms in describing your prospective role in overseeing DOE's site characterization activities.

Can you distinguish between the two?

Dr. Parker. I hope so. By "independent review", we mean people who are not tied into the present Department of Energy system who can have a fresh viewpoint, a different viewpoint possibly from a different culture.

I can just say from my own experience, when I left the Oak Ridge National Laboratory and moved to the university, over a period of years my viewpoint changed considerably. I do not want to say one was better or worse than the other, but it was certainly different.

I think the same thing is true in any organization, no matter what the organization is. If you are in that organization long enough, you absorb part of the culture of that organization. Having people outside that organization, therefore, with a different culture is very helpful, very beneficial to look at things with a different pair of eyes, a different viewpoint.

One of my professors once said they do not have the prejudice of experience. So I think that is what we mean by "independent review".

On the data, as I mentioned earlier, these are all volunteer workers. The Nuclear Regulatory Commission, as we have heard, has a large number of people who are working on this fulltime. In New Mexico, the State of New Mexico has the Environmental Evaluation Group with a number of very competent people working on it fulltime.

It is not possible for a volunteer group working on a very part-time basis on this problem to evaluate all of the data. In certain selected instances we might choose to do that because we feel the data is so crucial, but an overall evaluation of the methodology of analyzing the data is impossible for a volunteer group to do.

Senator McClure. Have you reviewed the evidence that the States of Nevada, Washington and Texas have presented that are considered by the states to be disqualifiers?

Dr. Parker. I have not seen all of it in detail, Senator. I do not think I am prepared to answer that at this time.

Senator McClure. Do you have any reaction to that at this time based upon what you have seen?

Dr. Parker. I think that in geological matters, one has to recognize an enormous diversity not only between sites but within sites, to expect a geological formation. So it would be like an assembly line where one can after another comes off exactly the same. This is an erroneous view of the real world.

To see that there are odd differences from what one preliminarily expects should not be surprising. In fact, it is quite what one should expect.

So I think the more we look at these sites, the greater changes we will find from the very generic simple view that we have as a conceptual view before we start. After we go into detail, then we will see all of the differences from our conceptual view. I do not think this necessarily disqualifies a site. It just means that we have to look at the site.

I think it is precisely for that reason that we called very early on for a shaft down to the proposed repository horizon and for tunnels and experiments within the exact horizon that would be used, because one cannot forecast from the surface no matter how many boreholes one drills precisely what one will find below there. I think that is the purpose of site characterization. Without it, I do not think one can make a firm view as to what the conditions will be underground.

I think, further, that we have not seen anything yet that would disqualify the sites.

Senator McClure. Thank you very much. I appreciate your testimony.

The Chairman. Senator Evans.

Senator Evans. Thank you, Mr. Chairman.

Let me just clarify something that Senator McClure talked about. Would it be accurate to say that your analysis or review of the Department of Energy's site characterization methodology was purely that, a review of the methodology and not a review, a scientific review in detail, of the way in which they carried out the methodology?

Dr. Parker. I do not think that is quite what I intended to say. We did look at the application of the methodology. We saw all the details on the post-closure analysis, how the methodology was applied for post-closure analysis.

We also saw all the details of how it was applied to one site upon the pre-closure analysis. What we did not see was how the pre-closure analysis was applied to the other four sites and the comparative weightings and rankings of the sites based upon that analysis. We saw that only when the methodology document itself was published.

Senator **Evans**. But you say in your testimony the work reviewed and the implementation and methodology of the Board did not undertake to review, nor did it review in detail, the data and the judgments on which the conclusions for the multi-attribute procedure were based.

Dr. **Parker**. That is correct, Senator. We did not look at the original data sources. If one looks at the volume of that, you can see——

Senator **Evans**. I understand the difficulty of doing that with essentially a volunteer board, as you pointed out.

What I am trying to get at is that your task was really aimed primarily at looking at the methodology chosen to determine whether that was an appropriate methodology and not to examine in detail the way in which the Department carried out or utilized that methodology.

Dr. **Parker**. We did look at how they applied the methodology. As I mentioned, we looked at all the post-closure sites, how they applied the methodology to all the five sites for post-closure. We looked at how they applied the methodology for one pre-closure, but we did not look at the data that went into that analysis. We did not review the original data.

Senator **Evans**. But you did indicate you were disappointed that the DOE did not utilize outside experts in the assessment process as well as in the review of the process?

Dr. **Parker**. I think that is true. I think Dr. Myers would like to add something to that.

Dr. **Myers**. The first thing that we were asked to do was to look at the methodology to see whether it was an appropriate methodology. We did that in the October review, and we concluded that it was an appropriate methodology as a decision-aiding tool.

We were then asked to look at the implementation of that methodology.

Now, what Dr. Parker was saying was that we were not able to look at the raw data to see whether the data that went into the implementation was accurate. What we were able to do was to look at the way in which the Department of Energy manipulated the data that existed.

Senator **Evans**. You are using manipulated in the scientific sense?

Dr. **Myers**. Scientific, yes; and whether the implementation, the application, was a correct application. The implementation was what our final report talked about, and our conclusion was that the methodology was correctly implemented given the accuracy of the data on which we took no stand, and that the results they came out with based on the five post-closure sites and the one pre-closure site were appropriate operations on that methodology with that data.

Senator **Evans**. You did not have available to you some of the staff workings on which there were strong comments, some of which could not be repeated in public?

Dr. PARKER. No, we did not, Senator.

I might note, though, that in the report on the methodology document that the rankings were not the same, of course, as the implementation document. So we did not find any evidence by the sensitivity analysis that the Department of Energy did, that even some fairly radical changes in the data would not have changed the rankings that actually appear in the documentation report, the methodology report.

Senator EVANS. Do you think cost is an important consideration in these matters?

Dr. PARKER. As a taxpayer, I certainly do.

Senator EVANS. You do say in here the Board believes that although there is no single generally accepted procedure for integrating technical, economic, environmental, socioeconomic and health and safety issues for ranking sites, the multi-attribute utility method used by DOE is a satisfactory and appropriate decision-aiding tool.

That presumes from your description of those various characteristics that economic and socioeconomic issues are an important and integral part of that decisionmaking. Do you believe it is appropriate, then, to ignore or set aside the question of cost even in pre-closure rankings?

Dr. PARKER. In the methodology document, costs are not set aside. They are factored in and are an integral part of the methodology document, sir.

Senator EVANS. Is it appropriate when they are overwhelmingly one way to then set them aside in terms of final decisionmaking?

Dr. PARKER. As the Board has pointed out, the methodology is a decision-aiding tool, and the final decision encompasses a number of other things, rock diversity, licensability, and political considerations. The Board has nothing to say on that.

Senator EVANS. So you are saying that this is a decision-aiding tool, and no matter what the end result of this process is in terms of the scientific factors or relationships that come out, the final decision can be anywhere by the decisionmakers?

Dr. PARKER. I do not think that is quite what I intended to say. I think what I intended to say is that all of these are factors, and I would certainly not think that scientific judgment alone ought to determine where major national priorities or decisions lie.

Senator EVANS. Let me put it another way. If it is a decision-aiding tool, those who wish to make certain decisions can make any decision they want utilizing whatever portions of a decision-making tool they feel are most important or whatever ranking they want to give to them. Is that correct?

Dr. PARKER. I think, as I mentioned, earlier, the advantage of this methodology that we reviewed is it makes it very clear what assumptions were made, what decisions were made. I think what you say is quite true.

If, however, in the methodology document it had been found that none of the sites passed the post-closure safety criterion and did not pass the pre-closure safety criterion, I think it would have been somewhat foolhardy on the administrator's part to choose one of those sites for characterization.

We saw in the methodology document, though, that all of the sites had extraordinarily high scores on post-closure factors and all had really quite good scores on the pre-closure.

Senator **Evans**. If that is a consideration, if they all had high scores on post-closure and then you start looking at pre-closure and all had relatively high scores in pre-closure, which I think is consistent with the statement of the Department that they feel there is a very high percentage chance of getting a final characterization successfully at any one of the sites, does that indicate to you that at that point maybe cost is a pretty important consideration?

Dr. **Parker**. Well, I think there are lots of items that would be important at that site and stage, and I would agree——

Senator **Evans**. If you have an array of five sites, all of which you say have a very high degree of possibility of being characterized successfully both for pre-closure and post-closure, would that not then tend to indicate as a prudent person the relativity of cost begins to rise compared with other factors?

Dr. **Parker**. Senator, you are asking me a question which is not a scientific question. I will be happy to answer it, but——

Senator **Evans**. Well, answer it as a taxpayer, then.

Dr. **Parker**. From a taxpayer's point of view, obviously I would like to save money wherever feasible.

Senator **Evans**. It is scientific at least to the degree of how you do a responsible kind of selection process. I think that if you get out of this multi-attitudinal decisionmaking tool of answers where, say, five sites or maybe even more than that for that matter all float to the top and all look, at least from what we know in that analysis process and at that level of analysis, that they are all pretty good, in fact all very good, then in terms of just plain scientific or economic analysis, does the relativity of cost take on greater and greater importance?

Dr. **Parker**. I am glad that Dr. Weinberg is still here. He wrote a very perceptive article a number of years ago on trans-science. He characterized this process that you are describing now as trans-science. It is not a scientific question. It is a social policy question based upon scientific information.

Senator **Evans**. Would you care to answer it, then, as a socioeconomic conclusion out of scientific data?

Dr. **Parker**. I can only agree with you. It is simply an interest in saving money consistent with health and safety.

Senator **Evans**. Surely.

The **Chairman**. Dr. Parker, thank you very much. The National Academy of Sciences is very much like the Supreme Court of Science, and so for you to give your statement, while the process, I am sure, can be improved, it is very helpful.

One final question. Dr. Weinberg said, and I quote, "If one were to judge by the estimates of most technical people, radioactive waste disposal is almost without exception not regarded as being a particularly difficult technical problem."

Do you agree with that?

Dr. **Parker**. I think it depends upon the level of conceptualization one is thinking about. I think there are very severe technical problems on some aspects of it. For example, our understanding of unsaturated zone hydrology is nowhere near as good as our understanding of saturated zone hydrology.

I think that was one of the things that I had in the back of my mind when I was talking about licensability of various sites. Now, some of us may believe that we know it sufficiently well enough that we can use bounding calculations to show that that is an absolutely safe site or a reasonably safe site, but to scientifically describe what happens to every single molecule of water or every single radioactive atom, I think that we could find lots of reputable scientific people who could raise very serious questions about every one of those molecules.

I think that where there is sufficient information that we can do in most instances bounding calculations to show relative confidence, but until we look at this, every site specifically, every site is unique in itself to those who look at it in great detail.

I do not think I would be prepared to say that there is no scientific disagreement. The methodology are about the sites themselves.

The CHAIRMAN. In fact, what you are saying is, if this is fair, that in order to license a site, we want to be as clear as we can on what happens to every molecule of those radionuclides; and understand we are not going to engineer these from a practical standpoint, we are going to engineer them from the perfect standpoint. From a practical standpoint, Dr. Weinberg is right, is he not?

Dr. PARKER. I think I would agree with most of that.

The CHAIRMAN. Thank you very much. We appreciate it.

Finally, the administration's spearcatcher. [Laughter.]

A man who does a good job with a very difficult task, Mr. Ben Rusche.

STATEMENT OF BEN C. RUSCHE, DIRECTOR, OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT, DEPARTMENT OF ENERGY

Mr. RUSCHE. Mr. Chairman and Members of the Committee, I am delighted to have a chance to visit with you again. I think the testimony this morning has certainly been interesting and illuminating, and I welcome the opportunity to speak further about the subjects you raised in your letter.

I am prepared to take any course you would like at this hour of the afternoon, from presenting an abbreviated statement with the full statement going into the record to just allowing the statement to enter the record and taking your questions, and I would be pleased to follow your direction.

The CHAIRMAN. You will be testifying tomorrow at 2:00 p.m. Your full statement will go into the record, and I would be interested in hearing any general comments you might have to make based on today's testimony and then maybe a short series of questions. We can defer the more detailed questions until tomorrow, but why do we not get your general comments based on today's testimony.

Mr. RUSCHE. Mr. Chairman, you asked us to address questions related to site characterization and plans for resolving technical issues raised by the NRC during site characterization and our plans for interacting with the National Academy of Sciences. I think that you have heard from spokesmen this morning on all three of these subjects to a considerable degree.

There is one question that I have covered in the testimony that is worth a brief mention. Perhaps you will want to raise additional questions with respect to costs; I will be pleased to try to discuss those. I believe Mr. Browning, if I am not mistaken, noted that it is very difficult sometimes when one is comparing costs, even about simple matters, to say nothing about a matter that is as involved as site characterization, to be sure that we are comparing apples and apples.

Let me briefly state what it is that we do with site characterization that will form the platform from which I will discuss further cost questions, if you have an interest. The purpose of site characterization is to collect the extensive geologic and environmental data that are necessary to evaluate the suitability of a site for development as a repository; to develop site specific designs both for repository-related facilities above ground and the repository itself below ground and for the waste package to be placed in the repository; to prepare an environmental impact statement; and to develop the information necessary to request a construction authorization for a repository from the NRC.

That is what site characterization is about, and that is what constitutes the $1 billion that we have been talking about——

The CHAIRMAN. Where did this estimate of $1 billion come from, do you know?

Mr. RUSCHE. It comes from the estimates that we have made for budgets, and I believe we will have an opportunity with you next week to talk about such budgets. I would be pleased to have some more detail.

The earlier, more recent estimates, let us say within the last year, have ranged from about $600 million to about $900 million. Now, with the extended time period that we have been directed by the Congress to take, which was not foreseen when we planned last year, these costs have crept up a little bit, and they are approaching $1 billion. The number is used in round terms. I have precise estimates for each site based on our best estimate today.

Please note, when we get through with site characterization for each of these three sites, presuming they are found suitable, we are obligated to have in hand a license application that we can put on the table with NRC within 60 days of the President's recommendation to the Congress of one of those sites under the Act. That means that we have no time to think about the sites. You have directed us to be prepared to proceed on that kind of schedule; therefore, we are doing a large amount of work in order to deal with that schedule.

The paramount issue is technical quality. I can assure you that that receives first attention in spite of the words that I heard someone talk about, recklessly proceeding and so forth. We are not recklessly proceeding. We are proceeding carefully and cautiously and with full consideration of both the costs and the necessity for quality. It is the Act that you have directed me to carry out; the Act does not leave much choice in the form that it is in right now.

I wanted to be sure that I got that description before you if we talked further on the subject.

[The prepared statement of Mr. Rusche follows:]

STATEMENT OF

BEN C. RUSCHE
DIRECTOR
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT

U. S. DEPARTMENT OF ENERGY

BEFORE THE

COMMITTEE ON ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE

APRIL 28, 1987

Mr. Chairman and Members of the Committee:

I appreciate the opportunity to appear before you today to discuss activities related to site characterization of candidate sites for the Nation's first geologic repository for spent nuclear fuel and high-level radioactive waste.

As you requested in your letter of invitation, I will focus my testimony on site characterization plans, the strategy for resolving technical issues raised by the Nuclear Regulatory Commission (NRC) during site characterization, plans for interacting with the National Academy of Sciences during site characterization and our strategy for assuring technical excellence through each step.

On May 28, 1986, the President approved the Secretary of Energy's recommendation of three sites for characterization as candidates for the Nation's first geologic repository for spent fuel and high-level waste. The three sites are: the Yucca Mountain site in Nevada, the Deaf Smith County site in Texas and the Hanford site in the State of Washington.

This was a major milestone in implementation of the Nuclear Waste Policy Act of 1982 (NWPA) and marked the beginning of the site characterization phase. Reaching this stage of determination permits us to proceed to investigate thoroughly, evaluate and compare geologic, environmental, transportation and safety factors at each of the three sites.

Prior to the nomination and recommendation of sites for characterization and through extensive field studies and analysis of tens of thousands of pages of documentation, DOE determined that all of the 9 potentially acceptable sites formally identified in February 1983 were qualified for further study based on the siting guidelines developed and concurred in by the Nuclear Regulatory Commission (NRC).

The selection of sites for nomination and recommendation was borne out of an extensive technical effort through which draft environmental assessments were prepared on each of the 9 potentially acceptable sites to analyze and evaluate available data relevant to the suitability of sites. A subsequent analysis entitled, Multiattribute Utility Analysis of Sites Nominated for Characterization for the First Radioactive Waste Repository -- A Decision-Aiding Methodology (DOE/RW-0074), was developed and finalized by DOE to aid in gaining insight into the attributes of the five nominated sites. The suitability and application of this methodology was reviewed and commented on by the National Academy of Sciences.

The decision-aiding methodology was a refinement of one of several methods proposed in the draft environmental assessments in 1984. It utilized the data and analyses in the environmental assessments in a decision process that allowed disaggregation of a complex set of objectives into component parts for evaluation and then reaggregation to determine both a composite ranking of the nominated sites and additional significant information relevant to determining an initial order of preference.

In addition, DOE considered the provisions in the siting guidelines for diversity of geohydrologic settings and diversity of rock types in arriving at a final order of preference. Based on these considerations, the Secretary determined the set of three sites for recommendation as candidate sites for characterization, which he recommended to the President. In addition, pursuant to the requirements of Section 114(f) of the NWPA, the Secretary made a preliminary determination that those three sites are suitable for development as geologic repositories consistent with the siting guidelines.

NRC has subsequently provided comments on the site selections, but while numerous concerns have been identified by NRC staff relative to each site, their concerns are of the nature anticipated at any site for which the existing database is limited. Such concerns we believe can only be addressed through the characterization process which was wisely established by the NWPA.

The purpose of site characterization is to collect the extensive geologic and environmental data that are necessary to evaluate the suitability of a site for development as a repository; to develop site-specific designs both for a repository and for the waste package to be emplaced in the repository; to prepare an environmental impact statement; and to develop the information necessary for a construction authorization for a repository from NRC.

Site characterization will take five-to-seven years, depending on the site. It consists of surface-based field studies, construction of an exploratory shaft facility and the detailed tests conducted below surface in that facility.

Surface-based field studies will involve data collection activities, such as geologic mapping, seismic surveys and hydrologic studies, as well as subsurface investigations conducted by deep and shallow boreholes that will be used for groundwater monitoring, core extraction, laboratory testing, and stratigraphic, tectonic, geochemical and geohydrologic studies.

Site characterization will also involve studies conducted in the candidate host rock in exploratory-shaft facilities. Exploratory shaft facilities provide access to detailed study of the potential host rock and will consist of:

(1) two exploratory shafts that will provide for access to the host rock, for the transport of people and equipment and for ventilation;

(2) underground testing areas; and,

(3) surface facilities needed to support construction and testing.

Exploratory shafts will be sunk to approximately the level where the underground facilities of a repository would be built -- 1,000 to 4,000 feet below surface depending on the site. At this level, the shafts will be connected to one another and to underground testing areas. The shafts and the underground testing areas will be used to conduct tests and make observations and measurements of site conditions. The surface-based tests will continue during the construction of exploratory shafts and will be continued in the exploratory shaft facility.

Although we had planned to begin exploratory shaft construction at one or two of the sites this fiscal year, Congress, in the appropriation for the waste program for Fiscal Year 1987, specified that no funds are to be used for drilling any exploratory shaft at any site in FY 1987. However, Congress did allow for site-specific work, other than exploratory shaft drilling, to be conducted at reduced funding levels.

The current activities at or related specifically to each of the candidate sites, include the following:

- At the Nevada site, land access is being pursued with other Federal agencies.
- At Washington, site plans are proceeding for hydrology tests that will precede exploratory shaft drilling.
- At the site in Texas, DOE is proceeding with its plans for obtaining access to the land, and has established an office of about 10 DOE and contractor personnel from our DOE Columbus, Ohio, Salt Office. Unlike the Nevada and Washington candidate sites, there has been no DOE office for this program located near the site or in the State.

Site Characterization Plans

Another major effort associated with site characterization is the preparation of a plan for characterizing each site. This plan--called a site characterization plan (SCP) is a major and intensive effort. The scope and magnitude of this effort can be gauged from the site-characterization plans now being prepared for publication: in each plan, the description of the characterization program alone covers several thousand pages.

Copies of each draft chapter are being shared with NRC, the States, and Indian Tribes as they become available.

The NWPA requires that such a plan for any candidate site be prepared, made available to the public, and that a public hearing be held by DOE in the vicinity of a candidate site before proceeding to sink the exploratory shafts at the site.

The SCPs are key documents and of major importance to States, Indian Tribes and the public -- as well as to NRC and to us.

The SCPs will provide a thorough status of what is known about the sites, describe the conceptual designs for the repository and waste package, identify necessary additional information requirements and present plans for obtaining all such information that is needed to support siting, licensing and design. The DOE is currently engaged in has an intensive effort of development and review of the SCPs for all three repository sites. This development is proceeding extremely well and is leading to extensive and high quality documents which carefully detail the logic for the data collection and evaluation procedures that will be needed to assure careful site characterization. The SCPs follow the Issues Hierarchy and issue resolution strategy approach briefly outlined in the Draft Mission Plan Amendment, (DOE/RW-0128), January, 1987, and covered in greater detail in the Issues Hierarchy, For A Mined Geologic Disposal System, (OGR/B-10), September 1986. The intensive effort underway will lead to issuance of the SCPs for the Nevada and Washington sites late this summer or early fall and for the Texas site early next year.

There is intense interest in the SCPs, because they will guide DOE during the site characterization phase until a license application is submitted to the Nuclear Regulatory Commission. The SCPs and periodic progress reports that DOE will be making, will have a crucial role in interactions with the NRC, and as vehicles for presenting information to the States, Indian Tribes, Congress, utilities and the public.

With regard to resolution of technical issues, the SCPs have been written using the SCP Annotated Outline (Annotated Outline for Site Characterization, Revision 1, OGR/B-5, March 1987) and the Issues Hierarchy in a manner to identify the issues and provide a rationale for their resolution. These issues are addressed in detail in the SCPs. While preparing the SCPs, DOE has met with NRC, States and Indian Tribes and reached agreement on the scope, content and approach being used for the SCP. In addition, a meeting was held with the NRC in May 1986, in which agreement was reached on the level of detail to provide in the SCPs.

To assure that critical issues are being addressed, a number of technical meetings with the NRC on selected topics have been held or are being planned for the near future. Meetings have been held with NRC, States and Indian Tribes to discuss the DOE Issues Hierarchy and performance allocation process, the geohydrology testing program for the Hanford site before construction of the exploratory shaft and proposed changes to the exploratory shaft facility at the Yucca Mountain site.

The technical issues raised by the NRC staff through their comments on the Environmental Assessments are being carefully and systematically considered by DOE in developing the issue resolution strategies contained in the SCPs.

Technical Issues raised by NRC

Resolution of specific technical issues raised by the NRC staff is expected to occur through a wide range of frequent interactions with NRC, the States and Indian Tribes. These will include review of Topical Study Plans, topical reports containing site data and results of design and performance analyses, meetings on topical issues, on site observation of testing and technical coordinating group meetings. Semiannual progress reports will be used to keep the NRC staff and others informed as to the status of DOE plans and progress being made during site characterization, including progress toward resolution of technical issues, and will act as a directory to all the various technical reports which will be issued during site characterization.

After issuance, the SCPs, will be reviewed by the NRC staff, affected parties, and public hearings will be heldand comments requested. The NRC has also agreed informally to provide early comments of any exploratory-shaft related concerns and, finally, NRC will provide detailed analysis and comment in their Site Characterization Analysis report which will represent a comprehensive statement of the technical issues of concern to NRC. The DOE is committed to consider all comments received and issue a comment response document. DOE will report on its site characterization program through the semiannual progress reports. It is anticipated that meetings on difficult topical issues will be held frequently with NRC, States and Indian Tribes as data collection proceeds, and DOE expects that NRC will review and provide comments on topical reports and other material provided by DOE for technical meetings. DOE will consider all comments and will attempt to reach closure on technical issues throughout the period of site characterization. DOE will document closure on technical issues in the semiannual progress reports. DOE will assure that all interactions are of the highest technical quality and that input from all technical experts is carefully evaluatedand that the public is kept informed of progress.

Interactions with Panels of the National Academy of Sciences

With regard to interactions with panels of the National Academy of Sciences (NAS) Board, the NAS Executive Commission recently approved a draft proposal to establish three site-specific panels to overview site characterization activities. DOE welcomes the opportunity to continue to receive the recommendations of the NAS. The DOE currently interacts with the NAS on topical issues, for example, The National Committee for Rock Mechanics, and will continue to encourage this interaction. We will be working closely with the NAS to assure that they have the information required to develop and implement their scope of work for their independent technical review. We will develop procedures in conjunction with the NAS that will assure that their appointed site-specific panels have timely and complete access to all plans and data available. We will also provide for routine meetings and briefings as requested by NAS on individual site-specific topical issues. NAS panel comments will be fully addressed as site characterization activities proceed.

Technical Excellence

Assuring technical excellence during all aspects of the site characterization process is the central focus of DOE's efforts. DOE is preparing the SCPs using state-of-the art procedures, such as the Issues Hierarchy and performance allocation process, and issues resolution strategy. The SCPs are being prepared by technical experts who are being required to think through the complete rationale for the process leading to the need for specific data. These project offices plans are being reviewed by a major DOE headquarters task force and by independent peer reviewers under a formal quality assurance process to assure the technical integrity of the test program. As discussed, these plans will undergo very external review by NRC, affected parties and others, and their comments will be evaluated and incorporated as appropriate.

The DOE plans to maintain this high level of review throughout the completion of study plans, test procedures, semiannual progress reports and laboratory, field and design activities. The procedures, summarized earlier, that we are putting in place, which include independent peer reviews within DOE, external peer reviews by NAS and frequent and extensive interaction with NRC, the States and Indian Tribes through meetings, technical coordinating groups and hearings, assure the technical excellence of the program through each step of the process. We are confident that the process we have in place will lead to the highest quality site characterization effort possible.

Mr. Chairman, this concludes my remarks. I would be happy to try to answer any specific questions you or members of the Subcommittee may have at this time.

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The CHAIRMAN. Let me ask you this. Would it be possible to have some kind of post like an inspector general for costs on these matters without compromising safety at all? Would that kind of post be possible?

We really have heard, especially in Europe, about estimates that we are spending too much. As I say, the French say that it is a dollar to a franc.

Mr. RUSCHE. I think the questions are not about accountability, Senator. The questions are programmatic direction that are included within the Act.

I would like to suggest that this proposal, I think, would not be a very good idea. We have the Government Accounting Office, which you and Senator McClure have directed to evaluate our program on a quarterly basis.

The CHAIRMAN. Let me tell you, we have asked for reports from those people. I understand they have nine people fulltime, and I think we have yet to get the first piece of paper from them, have we?

Mr. RUSCHE. Oh, no, Senator. Excuse me, Senator. They have published quarterly reports almost on time without fail. They have published annual reports, and they are in the final preparation of a programmatic report from the beginning of the——

The CHAIRMAN. They have never given us the answers on costs that we have asked for.

Mr. RUSCHE. I cannot speak to that question, since I do not know which questions you have asked.

The CHAIRMAN. We asked them what the cost was and why.

Mr. RUSCHE. I believe I have some documents that they have published of which perhaps I ought to provide copies to you if you have not seen them.

As I was saying, a document or study that is now nearing completion, it is not permissible for me to discuss the content of the document because it has not yet been released. I am not like a Member of Congress who can speak on such draft reports, as was the case the other day, but I have reviewed the draft. I can tell you that I believe it will give you a substantial amount of information.

I think the course that you laid out for the GAO was a very valuable course for the program.

The CHAIRMAN. The staff advises me that they have it, and it does not.

Mr. RUSCHE. Well, we have a different point of view on the subject.

Senator MCCLURE. May I ask a couple of questions on that?

The CHAIRMAN. Yes.

Senator MCCLURE. First, you said that as you were talking about what is in site characterization, you included in that the waste package that would be placed in each site.

Mr. RUSCHE. Yes, sir.

Senator MCCLURE. Does that mean the waste package would be different at each of the sites?

Mr. RUSCHE. It is certainly different between the salt site and the other two sites. For example, copper is an absolutely incompatible package material for salt. Copper, as we have studied and reported to you, appears to be a possible package material for the sites in the two volcanic rock environments.

Senator **McClure**. Second question. You suggested that the programmatic direction which you have received drives costs.

Mr. **Rusche**. It certainly does.

Senator **McClure**. Could you make a suggestion to us of a different programmatic direction that might save costs?

Mr. **Rusche**. Senator, I am not sure I have ever had the luxury, when I am charged with carrying out the law, to suggest different courses.

Senator **McClure**. I am offering you that luxury now.

Mr. **Rusche**. The Secretary and I have offered such a course, and we have found that it was not very well received with respect to the second repository.

Senator **McClure**. Well, that is one. [Laughter.]

Do you have another suggestion?

Mr. **Rusche**. I am not sure about two and three.

Senator **McClure**. Very seriously, I think we know that there were certain parameters we had in our mind when Congress passed the Act. Some of those factors have changed. We are aware of that.

What I am asking you is if indeed that package we have given you—and you have described one just now in which you have to move from recommendation to license application in 60 days. That obviously means that you have to do an awful lot more work before you make a site selection on all sites. That is a cost factor.

Mr. **Rusche**. It is, indeed.

Senator **McClure**. It also means we have done a better job of characterization of each of the sites. There is a tradeoff. Is that a good tradeoff or would you have us do it differently?

Mr. **Rusche**. From the standpoint of cost, the judgment of the balancing that has to be made by the Congress is whether it is worth that cost to have confidence in the schedule. It is the schedule that drives those kinds of activities.

I think there is no question that if an industry were seeking a site for an activity and had multiple possibilities for sites that the industry would select the most promising site from amongst them and attempt to move the selection of that site. It would not do the sort of thing that we are talking about.

It is my presumption, based on the language in the Act and its literal content, that it was important in the minds of Congress when the Act was adopted in 1982 that the program proceed at a certain pace. This Act, as you know better than I, is one of the most prescriptive pieces of legislation around. The very bulk of that prescriptiveness does not leave much to one's imagination about what was in the mind of the Congress.

Certainly if the Congress were prepared to accept the risks of schedule, then characterization on a sequential basis is a course that one might want to consider. It certainly would have the potential for saving money except that, in the long run, if choices were made that were found unacceptable early on and three sites were eventually required to be characterized sequentially over a period of 20 years rather than doing them over a period of 5 to 7 years, you can rest assured that the cost at the end of 20 years would greatly exceed the cost of having done all three in 5 to 7 years.

These are the kind of judgments that are important in looking at costs.

If I may continue for one second, Senator Evans a moment ago raised the question about cost and making the judgment on selection of sites when he was speaking to Dr. Parker. I would note that it is entirely appropriate to consider cost when selecting such sites, but the costs that were considered were the costs for characterization. The costs for characterization for the three sites is about the same.

The costs that I believe you were referring to were the costs for the total program for each of the sites which was the cost element that was included in the multi-attribute utility analysis. There is a difference, again making it extremely important that we all be sure that we are talking about the same thing when we use these cost numbers. It is not a question out of criticism. It is just a recognition that cost is a term applied to many pieces of the program as well as to the aggregate of the program.

Excuse the long answer.

The CHAIRMAN. Mr. Rusche, S. 839, as you know, provides that if you get an MRS in place, that is a state which signs up for the MRS, then you can do away with characterization at the two other sites. You can characterize only one site for the permanent repository.

Now, my question to you is, first, having the MRS in place would take the time pressure off on having three sites characterized simultaneously, would it not?

Mr. RUSCHE. It would if the law were changed to acknowledge that.

The CHAIRMAN. I mean, we could prudently change the law then by changing that date.

Mr. RUSCHE. Indeed. In fact, I think in some of the material that we will talk about tomorrow, I pointed out that you can save $1 billion between 1998 and 2003 in terms of additional on-site storage for the dispersed reactors if the MRS is in operation compared to it not being in operation. I will be prepared to discuss that with you tomorrow.

The CHAIRMAN. So, in effect, you believe that that schedule in S. 839 would be prudent; and, therefore, it would be prudent to sequentially characterize the three sites pursuant to S. 839 if you have an MRS?

Mr. RUSCHE. Senator, again I would have to say if it were the sense of Congress that the Act in its current form deserved changing; but these two are not compatible in that sense, just as I think Mr. Thompson was speaking this morning. If the remainder of the Act stays in place and those schedule commitments are there, then it would not be very wise to go to one site to characterize.

I think the chances, in spite of our high impression of the quality of those sites and the likelihood that any one of them will be found acceptable, to give you assurance that it is a prudent course to try to meet that schedule I think would be unwise.

The CHAIRMAN. I think it is implicit in S. 839, and we probably should make it explicit, that if we have the MRS in place and go to the single-site characterization, then we would slip the date. That could prudently be done.

Mr. **RUSCHE**. From the standpoint of being able to handle the waste, yes, sir.

The **CHAIRMAN**. From any other standpoint, could it not be prudently done?

Mr. **RUSCHE**. I can think of no other point other than the final view of Congress as expressed in the Act that geologic disposal is the right long-term disposal method. I think that there would want to be preserved in that relationship some confidence that geological disposal was yet to be pursued in order to measure, to test the prudence.

The **CHAIRMAN**. Well, it certainly would be. I mean, we would not be spending $1 billion to characterize a site if we did not intend to use that site.

Mr. **RUSCHE**. That would certainly be my view, yes.

The **CHAIRMAN**. Even though we are saving $2 billion, $1 billion is still a lot of money.

Mr. **RUSCHE**. It is a very large amount of money.

The **CHAIRMAN**. Now, one final question and I must go to our caucus. You will be available tomorrow, and we will have further questioning tomorrow. If I may turn it over to my colleagues. I will have some questions in writing which I will not ask at this time, and I will defer further questions until tomorrow.

Thank you very much, Mr. Rusche. You are the man on the spot with a very difficult program. I repeat, I think you have done a very fine job, and I think this testimony today has vindicated what the Department of Energy has done; not perfectly, certainly not perfectly with respect to the eastern repository, but a pretty good job. We will give you an A minus.

Mr. **RUSCHE**. I understand that is one.

The **CHAIRMAN**. That is one. Thank you.

Mr. **RUSCHE**. Thank you, sir.

Senator **MCCLURE**. [Presiding] Thank you, Mr. Chairman.

Mr. Rusche, you have been careful in your answers thus far to say it is up to the Congress to decide what the policy is. Congress has done that in the law that has been passed, and your answers are in the framework of the existing law.

Mr. **RUSCHE**. Yes, sir.

Senator **MCCLURE**. I think that is appropriate. I appreciate that.

You have not, however, always worn the hat that you wear now. You are a man with broader experience than that. You are not just within the confines of administering this statute. You have knowledge that we would like to draw upon. Part of my questions, therefore, are not directed towards how you interpret the present statute but what you believe current policy should be.

Now, let me go back as a backdrop to the question which I will ask. Three perceptions that we had at the time the Act was passed, now some 5 years ago almost, over 4 years ago:

One, nuclear reactors were running out of storage space as designed at the time the power reactor was designed and licensed and that if they did not find some way to store spent fuel assemblies, they would have to shut down. They would not be able to refuel. That meant they either had to find a way to rerack or to store them at some other site or in some other way, and there was uncertainty as to how that was to be accomplished in time to avoid plant closure. Fact one, I believe, and you remember those discussions, I think.

Mr. RUSCHE. Indeed, I do.

Senator MCCLURE. Second fact. We at that time still had an active nuclear program in this country. It was not just a question of the 100-odd plants that were operating or under construction. There were contemplated others.

I would suggest that four years ago or five years ago, looking at the industry and the energy problems of this country and the energy programs in this country, it was anticipated that in the intervening period of time there would have been some new orders for plants. So we were looking not just at an existing situation but an expanding situation.

Is that not correct?

Mr. RUSCHE. I think that certainly was the view on the part of some people.

Senator MCCLURE. Third fact, which was then obvious and may still be apparent, is that there were those who did not want an expanding nuclear capacity in this country for whatever reason, an argument that you cannot have a new one until you show us how you take care of the wastes that you are going to generate.

Is that not a fact?

Mr. RUSCHE. I think that is unquestionable.

Senator MCCLURE. Congress, therefore, looking at those, had to come up with some immediate answers to storage of spent fuel assemblies, had to look at the needs of an expanding industry, and they had to also look at the public climate of acceptance that would meet that question of what are you going to do with those wastes if you start a new plant.

Now, if we look at those three things, the first is not the same problem that it was 5 years ago. We have reracking. The NRC has licensed reracking. They have licensed dry canister storage. We have some extension of time on that front; is that not correct?

Mr. RUSCHE. That is correct.

Senator MCCLURE. Secondly, we do not have an expanding industry at this time. There are no new license applications. What we see is what we have. I do not think anybody is really expecting that in the next two or three or four years we are going to see a whole lineup of new license applications.

Is that accurate?

Mr. RUSCHE. I think that is true.

Senator MCCLURE. Finally, if that is true, then it affects that other question with respect to the necessity of moving to geological storage as the final answer to the fundamental question, because it is not affecting any fundamental current judgments.

Is that not correct?

Mr. RUSCHE. Senator, that one is much more difficult for me to answer, in that I was a party to the discussion in the pre-1982 period both with the Senate and with the House when I was with Secretary Edwards. I think you get much closer to a philosophical question or a sociopolitical question there than you do a technical question.

I think that the question as to whether this generation ought to be responsible for moving to permanent disposal is a very broad social issue. There clearly were different points of view then, and I think there still are different points of view today on that subject.

Senator McClure. But the urgency on timing is a little different.

Mr. Rusche. I think the urgency on timing probably did not exist even then on that kind of philosophical question.

Senator McClure. Right. Certainly, I do not quarrel at all with your fundamental premise that there is a moral point of view about the responsibility of this generation, the future generation.

Mr. Rusche. Yes, sir.

Senator McClure. That still exists, and I think it is valid.

If the time pressures for immediate reracking, immediate refueling and the time pressures with respect to final decisions have been relieved at all by the changes in the energy picture in this country today, then perhaps we have an unrealistic time frame expressed in the current statute.

That is the reason I invited you a moment ago to express yourself as to whether or not there are changes to the existing act that could benefit your program. I know you have been criticized of some of moving precipitously. Some have said recklessly. I think that is the term they used. My response has been that the law requires you to meet deadlines.

Maybe we gain more in public acceptance and public confidence in the program if we allow it to unfold slightly more deliberately than the current timetable requires of you.

Do you have a comment?

Mr. Rusche. Senator McClure, I think that may be an appropriate course. I do not mean to sound impertinent, but the one case in which we have attempted to make such a suggestion, in which we saw a clearcut, practical judgment which we thought was warranted, has not been well received.

Senator McClure. You mean the second repository.

Mr. Rusche. Yes, sir.

Senator McClure. Well, let me make a distinction so that I may encourage you to answer more fully. That decision was one in defiance of the law, not one in conformance with the law. It was not a suggestion that the law ought to be changed. It was a suggestion you are going to change policy even though the law did not change.

Now, what I am asking you is not how you change your policy in defiance of the law or outside of the law but what suggestions you would make with respect to changes of the law. I would take it as given that you would suggest that the requirement for a second repository be dropped from the statute at this time.

Now, I am not even going to ask you to comment on that unless you wish to, but beyond that, are there changes in the law that we really ought to enact in view of 5 years of additional experience?

Mr. Rusche. I think there clearly are questions that deserve reconsideration. They are not unrelated to the second repository or separate altogether from the first repository, but it is clear that the 70,000 metric ton limit on the first repository, which has a cascading effect throughout a number of programmatic elements, might deserve reconsideration.

It gets you very quickly to that question of geographic diversity and equity. It gets you very quickly to that question of a satisfactory geologic disposal system. If you take the view that such an acceptable system for the country needs to have two repositories in it, then the 70,000 metric ton limit forces that conclusion, and that may have been the intent of Congress. Whether it was the intent or not, that is the effect, to be sure.

So I think that the kinds of things that we are asking for now are clarifications in one sense to that effect. I think we would suggest that that needs to be looked at.

Again, I think that if the schedule that Congress originally established is, in light of the factors that you have mentioned, no longer as urgent, and I think there are certainly reasons to believe that that is the case, then I think perhaps one should look again and see whether the concurrent characterization of sites is the most practical way in which to proceed.

It is not easy to say that sequential characterization is the most economic, but it certainly has elements that might make it the most economic if we were fortunate in our choice. I think that perhaps deserves a look.

I am in the awkward position, though, that as much as you try to remove from me the obligation to look at the Act as it exists, it is very difficult for me to speak in the absence of the Act because we have tried so diligently to carry out the Act. I think at least looking at whether there is a need for two repositories certainly deserves consideration, and a 70,000 metric ton limit is certainly related to that.

I think the importance of having a diverse system with two elements with an MRS which Congress has not yet acted on or has not yet authorized and a repository deserves very serious and hopefully very urgent consideration by Congress. I think if MRS is confirmed or authorized, then these other considerations might be a little bit easier.

I hope I have not evaded your question.

Senator McClure. No, you have not. The MRS decision, if affirmed by the Congress, would give you more time for the other. Is that what you are saying?

Mr. Rusche. It would, indeed, give more time, but I think it would be very important to keep connected with it that more time is not unending time. Now that is my personal view.

Senator McClure. No, I think your answers have been responsive and very helpful, because, again, one of the reasons for the 70,000 metric ton limit was precisely what you suggested, and that is to force a second repository. Part of the political consideration which existed then and exists now is the resistance on the part of the state where the first repository will be sited of having to accept all the country's nuclear waste. Why us? Spread this around a little bit.

I guess that is probably not less true today than it was 5 years ago.

Mr. Rusche. I think it is more evident today than it was 5 years ago, to be sure.

Senator McClure. It is more focused.

Mr. Rusche. It certainly is.

Senator McClure. Thank you very much. I have some further questions which I will submit for response in writing.

I will turn the gavel over to my colleague from Washington.

Senator EVANS. [Presiding] Thank you, Mr. Chairman. I will try to be brief today because we have another shot tomorrow, I guess.

In this analysis of the total system life cycle cost, volume one, one of the tables does have the various elements that are involved in the site characterization process.

Mr. RUSCHE. Yes, sir.

Senator EVANS. Now, is that about as detailed a breakdown as we have available?

Mr. RUSCHE. I think it is.

May I make one comment on that point? I wish I could have made this to Senator Johnston and Senator McClure as well. I have been interested in the cost since I arrived and since you were kind enough to confirm my appointment, but it has taken on greater significance as these costs have continued to grow.

With respect to our interaction with our European friends, I have commissioned a conference that will be held next month in Washington in which the representatives of Canada, Sweden, Switzerland, and the United States, who are deeply involved in a number of collaborative efforts will attempt to look at these cost elements and prepare a common cost estimate, that is, an estimate that involves common elements, so that you and other Members of Congress as well as ourselves can be as confident as we can that we are making valid comparisons.

Senator EVANS. I think that would be helpful.

Mr. RUSCHE. I would be glad to prepare that and make that available when it is done. It will probably take a month or two to do it, but you will have it soon.

Senator EVANS. I should say that you are right. We should identify which costs we are talking about. I knew perfectly well which costs I was talking about, and I think you did, too.

Mr. RUSCHE. I just wanted to be sure.

Senator EVANS. I believe the costs that I mentioned in my previous questioning did not have anything to do with site characterization, as I am sure you know. They had to do with——

Mr. RUSCHE. The total life cycle analysis.

Senator EVANS. The costs related to the final cost of pre- and post-closure construction and associated costs.

I have expressed my concern before. We do not need to engage in an exchange because I think we may disagree. I think to leave costs out when there is this great assurance that scientifically there is high probability of successful characterization of all sites was an error, maybe an irretrievable error, but it led to the selection of three sites which probably would not have been the same three sites if cost had been an important consideration.

Mr. RUSCHE. May I be allowed one comment?

Senator EVANS. Surely. Oh, sure, yes.

Mr. RUSCHE. I would agree with you that cost will probably be the determining factor. If we characterize three sites, it will be the single most determining factor in selection of a final site. Selection of sites for characterization was not the time at which to use that as the determinant. Inclusion of diversity further drove us in the direction of selecting diverse sites.

Senator EVANS. I understand the diversity question.

Mr. RUSCHE. I believe cost was properly considered at that time, although we disagree and I will not pursue the subject.

Senator EVANS. Well, I will not pursue it, either, because that is done.

You have repetitively talked about the Act, and it reminds me of General MacArthur talking about the Corps. I think that is both appropriate and commendable. I wish others in the administration always were as diligent in faithfully following the acts that we pass up here.

Let me do what Senator McClure tried to and maybe carry it even a little further. Assume that there was no act, that you are before us today knowing not what we knew in 1982 but what we now know in 1987, and we were to try to craft the best possible act to carry out the problems of nuclear waste storage.

Would you recommend at this point that an MRS take a more important and first-place role than it did under the Act as drawn in 1982?

Mr. RUSCHE. Well, certainly, because the Act drawn in 1982 left no specific role for MRS. It left open the question. I think our proposal makes clear that we think it is an essential element.

Senator EVANS. Okay. So if we were to draw an act today, we would pay close attention.

Would you also suggest that that would clearly be the first element to move forward on and construct even though, assume for the moment, we are talking about still working toward a long-term geologic storage?

Mr. RUSCHE. With that assumption, without question.

Senator EVANS. Okay. Did I understand you to say that if an MRS were in place in the late 1990s that you could save $1 billion in that 5- or 6-year period from then on as opposed to not having an MRS in place. Is that correct?

Mr. RUSCHE. Yes, sir, and let us be sure again that I get the message clear. If you look at the amount of additional storage capacity that would be required between 1998 and 2003 for at-reactor storage, and if you assume that an MRS was operating and available to accept the mass of material for which such reactor storage would have to be constructed or provided, the differential is about $1 billion for storage at MRS as opposed to storage at individual reactors.

Senator EVANS. So I think I have just figured out a way to save another $1 billion. In other words, what you are saying, in effect, is that if an MRS costs approximately $1 billion to construct or go through the whole process, including construction, which I think is in your testimony——

Mr. RUSCHE. Yes.

Senator EVANS [continuing]. That if you save $1 billion, then the net cost is zero. Is that not effectively right?

Mr. RUSCHE. That is a way to look at it.

Senator EVANS. Well, I think that is a pretty good way to look at it.

Mr. RUSCHE. I think it is, too.

Senator EVANS. If you save $1 billion and it costs you $1 billion, the net cost is zero.

Mr. **Rusche**. Well, again, the assumption made on how you take care of that additional capacity is subject to some variation. I have made one set of assumptions which is straightforward. With the exception of that, yes.

Senator **Evans**. Excepting those assumptions.

Mr. **Rusche**. Yes.

Senator **Evans**. If we had an act now that gave you the appropriate go-ahead and if this is how we crafted one to move ahead and to construct an MRS, at that point would you agree that we have given ourselves additional time? We have taken away some of these horrible time frames that we have given you in terms of final opening of an deep geologic storage. In other words, we have given ourselves a better and more appropriate interim storage facility which can accept and keep waste for a substantial period of time.

Mr. **Rusche**. Yes, Senator. I would have to make one caveat on that, and I hate to keep referring to the Act, but our proposal, made in light of the Act, proposes that the Congress limit the storage capacity at such an MRS to 15,000 metric tons. If that were maintained, then the time period is not extended very far.

Senator **Evans**. Unless we construct more than one MRS.

Mr. **Rusche**. Or you allow the capacity to be greater than 15,000 metric tons.

Senator **Evans**. Let us, by definition, say we are not going to use the term "act" anymore, that we are crafting something here. If we are crafting something, we can make an MRS as large as we want to, or if we choose not to make it any larger than 15,000 tons and there is more waste to be stored for an extended period of time, you can have more than one MRS.

Mr. **Rusche**. At additional cost.

Senator **Evans**. At additional cost. We just saved $3 billion, $2 billion I guess, so we have a little to work with.

Mr. **Rusche**. We have to be sure that we got our accounting straight, now.

Senator **Evans**. I understand. I am in the process of saving all that.

With that concept that either a single MRS could accept more than 15,000 tons or two MRS or several could be built, then in your view would it make sense to proceed sequentially in the site characterization a deep geologic storage?

Mr. **Rusche**. I think it certainly makes sense; it is my view that Congress would want to preserve the commitment of this generation to permanent disposal. I am giving now my personal opinion.

Senator **Evans**. I understand.

Mr. **Rusche**. If Congress does not care to make that commitment for the country, I would not want it to be on my suggestion. I think this generation is obligated.

Senator **Evans**. I think that Senator McClure said it pretty well. We would not proceed ahead. I am talking about proceeding sequentially, not ceasing to proceed at all.

Mr. **Rusche**. Yes.

Senator **Evans**. If you proceed sequentially, the first sequence is the better part of $1 billion. That is a fair commitment.

Mr. **Rusche**. I think that is a reasonable business course to follow and certainly sound from a technical standpoint.

Senator EVANS. All right. One other thing on this question of a current generation. Is it possible as the years go by that we may decide that there truly is value in the waste that we are now setting aside, that for whatever reasons we choose not to reprocess waste now, we may find that for future purposes reprocessing is a desirable thing to do?

If we have then proceeded to deep geologic storage in order to take care of this generation's responsibilities and not push the problem off on the next generation, is there at least a small possibility that by putting it in deep geologic storage, making it very difficult to retrieve again, that we are taking away from the next generation the opportunity to use what may be useful?

Mr. RUSCHE. I do not believe that is the case, Senator. I believe any repository that we build, certainly any in light of the current NRC rules, would be required to maintain retrievability for 50 years. Prudence would suggest that it ought to be longer than that. If that were the case, then I think that the assertion you made would not be valid.

Senator EVANS. It would be in 100 years or 200 years.

Mr. RUSCHE. Or 500.

Senator EVANS. Well, we are talking about future generations. I mean, you have to make that same assumption. If you make it on the side of our taking care of the waste so that the next generation does not have to, that is not just the next generation. That presumes that generations during all the time that the waste is a problem.

Mr. RUSCHE. If you made it for 100 years, then three generations from now that generation could determine whether the asset was valuable enough to maintain retrievability or to go ahead and close the repository.

Senator EVANS. But if we had closed the repository in the meantime——

Mr. RUSCHE. But we are not going to close it.

Senator EVANS. Well, not for some time, but we eventually will.

Mr. RUSCHE. For 100 years. So I do not think that that argument is very valid.

Senator EVANS. It will be valid at some point.

Mr. RUSCHE. I agree, long beyond my time and that of my grandchildren.

Senator EVANS. The next generation is beyond our time.

Mr. RUSCHE. I am already thinking about my grandchildren. In fact, I have a couple of pictures I would like to show you. [Laughter.]

Senator Evans. Well, you have me there. I have no grandchildren yet.

Mr. RUSCHE. I know nothing about General MacArthur's Corps, and I was hoping you would tell me about that later on. That must have been before my time.

Senator EVANS. Yes. [Laughter.]

Before mine as well.

Again, leaving the Act or even current political feelings aside, do you have any comment on the French approach toward reprocessing which gives them valuable materials which they put back into the fuel cycle and reduces the volume and type of waste rather radically that needs to be put into a permanent repository?

Mr. RUSCHE. I think the first point with respect to valuable material is purely an economic question, and I think it is much harder on America to make such decisions on what I would call a centrally planned basis which can be done to some degree more effectively in the kind of system that the French have. That is not to say it is better or worse, but it is just different.

With respect to the waste question, I believe that there has been some, maybe not exaggeration, but I do not believe that the effect on the waste disposal problem is nearly as large as has been alluded to even this morning with respect to the difference between reprocessed material and spent fuel. There is a difference, but in the design of a repository or an MRS, it does not make that much difference from a technical standpoint.

Senator EVANS. There certainly is a very substantial difference in volume.

Mr. RUSCHE. Again, Senator, what you are disposing of is heat, and heat determines how you design the repository. The volume factor becomes a relatively insignificant design parameter.

It does determine the number of design packages. So from an operating standpoint, you might end up with fewer packages. There are minor factors, but it is not a significant factor in my opinion.

Senator EVANS. Well, certainly the heat is the factor. In an MRS itself, the French in putting the vitrified cylinders right at the surface or from the surface down in concrete——

Mr. RUSCHE. You must have been to AVM.

Senator EVANS. Well, this is at Marcoule.

Mr. RUSCHE. Yes, that is AVM. AVM is the facility.

Senator EVANS. Again, we were also at La Hague, where they are building a much, much larger facility.

Mr. RUSCHE. A pool.

Senator EVANS. No, no, a vitrification plant and the whole works.

Mr. RUSCHE. Yes, but the storage now at La Hague is in pool form.

Senator EVANS. Currently it is, that is correct. It will not be. It will be dry storage as it is in Marcoule when they vitrify.

Mr. RUSCHE. Yes.

Senator EVANS. But once having vitrified, they said that they only need to use air convection as a coolant. These are close together. The nine cylinders that go down vertically are set, for all practical purposes, next to one another, maybe a foot and a half, two feet apart.

They require forced air cooling for about 5 years, and then they say that the casts are at that point cool enough so that air convection created by the heat remaining in the casks is sufficient so that they will not get internal temperatures that cause any difficulties and that they can, for all practical purposes, sit and watch it with nothing effectively being done.

Do you have any comment on that?

Mr. RUSCHE. I think that is just a straightforward engineering design question, and as the French have done it or are doing it, it could be done. If a body has as its objective isolation, such as in the repository, it takes a different engineering approach. It is purely a matter of engineering design. There is nothing very unusual about that.

Senator EVANS. If that is engineering design, had it been a warehouse which we walked through, a warehouse that is probably bigger than a basketball court but not a whole lot, and it holds a significant amount of the waste which had been produced over an extended period of time in the French system—in fact, I think their term was that the high level that they have created during the course of the operation of all of their plants from the beginning to today is in a volume that is not much larger than an olympic swimming pool. It is 3,000 cubic meters, I think they said.

Be that as it may, if you get to a point where these are in-concrete cylinders, the waste is vitrified, they are below the surface but only below the depth of the cylinders necessary to take nine of these casks, one on top of the other, after 5 years natural convention is sufficient, and at least they thought it was safe for us to walk on the floor which is poured over the casks, is there any real length of time that that is not a sufficient method by itself of storing waste?

Mr. RUSCHE. I think there are two questions. One is: Is that a reasonable arrangement? Without trying to be short, that is purely an engineering question.

Senator EVANS. I understand, but assume it is a reasonable arrangement for a temporary period of time.

Mr. RUSCHE. I would not think that is an acceptable course for the long term.

Senator EVANS. You say it is unacceptable?

Mr. RUSCHE. I would not think so, and I am speaking as a person. My personal opinion is that that kind of situation, even though it is suitable perhaps in the arrangement that you described for convective cooling to provide whatever cooling is necessary, it is still accessible. If it is providing motion of the air, movement of the air, it is accessible to the environment, then I think that for the long term that is a consideration that is not consistent with the idea of isolation from the biosphere.

I think that many people believe, and I am one of them, that at some time that waste needs to be isolated from the biosphere. So I would not think that would be a suitable long-term disposal means.

It is certainly workable. We can make it workable. For example, the concrete storage casks that we envision with the MRS, which proposal we will talk about tomorrow, rely on conduction and convection to the atmosphere for dispersal of that heat.

Again, it is purely a matter of selecting the parameters, engineering parameters and radioactive parameters, in a manner that is compatible with circumstances, which is fairly straightforward to do.

Senator EVANS. As long as there was a long-term or deep geologic place where it could not, or at least by best estimates, could not violate the biosphere, that interim period of time where you would be able to carefully monitor and watch it, you would not be upset if that was 50 years?

Mr. RUSCHE. No.

Senator EVANS. One hundred years?

Mr. RUSCHE. Questionable.

Senator **Evans**. Tell me how many years before you get kind of nervous about it still being there. From an engineering standpoint, it is probably better after 100 years than after 50, is it not, less radioactive, less heat?

Mr. **Rusche**. By about a factor of two.

Senator **Evans**. Okay, so it gets better, but that is something I think——

Mr. **Rusche**. That is a relatively minor factor, again, from an engineering standpoint. That is a minor factor from an engineering standpoint.

Senator **Evans**. When does your comfort level disappear and you want to get it into deep storage?

Mr. **Rusche**. I think that this generation has an obligation to set something in motion that is predictable. What we have done from 1982 until now leads us to the question of whether we can do it for 4 years or not.

Senator **Evans**. But let us assume that it is predictable and that we have a long-term storage out there. I am trying to get some sense of the length of time in the interim that you feel is appropriate.

Mr. **Rusche**. It is purely a matter of cost and attention. I think it becomes purely a sociopolitical question as to how long that time period ought to be.

In fact, you probably will not appreciate me saying this, but you can do that with waste tanks like in Hanford. As long as you are willing to watch them and manage them and maintain them—

Senator **Evans**. We do not have a good record of that from the past. [Laughter.]

Mr. **Rusche**. Well, some are better than others, to be sure. Nevertheless, you were willing to make assumptions about the long-term future. To the extent that you are, then the question becomes one that is not technical.

I do not want to insert my personal view too strongly in the subject, and I cannot speak about that thing.

Senator **Evans**. Sure. Okay. Well, we have kept you a long time. I appreciate your efforts in helping us rewrite the Act. [Laughter.] I think we have just discovered a whole new direction.

Mr. **Rusche**. Senator, I hope that from this meeting that never appears as the case. I have been attempting to respond to your questions under a hypothetical set of circumstances.

Senator **Evans**. I should say in closing for the record that you have not suggested that we reopen the Act, that you are a faithful adherent to the current act, and that I still thank you for your help in giving us the opportunity, if we choose, to rewrite the Act.

Mr. **Rusche**. My adherence is not blind but considerate.

Senator **Evans**. I understand that.

With that, this hearing is adjourned until 9:00 a.m. tomorrow, Wednesday, April 29, 1987. Thank you.

[Whereupon, at 1:10 p.m., the hearing recessed, to reconvene Wednesday, April 29, 1987.]

NUCLEAR WASTE PROGRAM

WEDNESDAY, APRIL 29, 1987

U.S. SENATE,
COMMITTEE ON ENERGY AND NATURAL RESOURCES,
Washington, DC.

The committee met, pursuant to notice, at 2:07 p.m. in room SD-366, Dirksen Senate Office Building, Hon J. Bennett Johnston, chairman, presiding.

OPENING STATEMENT OF HON J. BENNETT JOHNSTON, A U.S. SENATOR FROM THE STATE OF LOUISIANA

The CHAIRMAN. The subject of this afternoon's hearing is the Department of Energy's monitored retrievable storage facility proposal. This proposal is submitted in response to the directive of section 141 of the Nuclear Waste Policy Act of 1982. Under the act, the proposal was to have been submitted on or before June 1, 1985, so the proposal is late but we are glad it is finally here. I think, as a matter of fact, it was prohibited from being here by court judgment, was it not?

Section 141 is a part of the act for which I have a great affinity born of pride of authorship. Actually, Scoop Jackson and Frank Church were also original sponsors of the MRS in the Senate. I have thought that the MRS makes a lot of sense for a long time. I think others are also looking to see the value of the MRS.

Let me repeat some of the advantages of the MRS in order that the record of today's hearings will reflect them. First, MRS is something we know how to do. We know how to do it because it is being done. It is being done in Sweden, and it is being done in France. We saw those facilities over the Easter recess. There is no doubt that it is safe.

MRS is what we do with fuel that is taken out of domestic nuclear power plants, except in this case the fuel is stored on site at the reactor, that is in the case of onsite storage.

Indeed, in the United States we have 60 or more, you might call them, MRS facilities; that is, one at each reactor site, temporary storage of nuclear waste at the site.

Second, MRS can be sited anywhere. A geologic repository can only be sited in a very special and, therefore, relatively scarce geologic environment. An MRS facility, on the other hand, has no strict siting requirements. So the location of MRS can be selected to emphasize other values in the program such as minimizing transportation impacts.

MRS lets us get on with the job. Under the authority of the Nuclear Waste Policy Act, we have collected nearly $3 billion from the Nation's ratepayers. This money is payment to the Federal Government for management and disposal of spent fuel, but no fuel has been accepted by the Federal Government because there are no facilities to receive it.

These ratepayers are making very substantial construction work in progress, or CWIP as we call them, payments to the Federal Government. If we had an MRS today, these ratepayers would be getting services for their money. We would have real experience with spent fuel management instead of only a lot of paper studies. We would have confronted the licensing problems, the transportation problems, and we would be getting on with the problem.

One of the biggest advantages of an MRS, as repeatedly told us by the French and the Swedes, is that you reduce the problem for the final repository by many decibels by cooling those wastes over a period of time. You not only cool them so they do not have the waste heat problem, but they are much less radioactive.

I believe we ought to assure the designers of our geologic repository that we will not put wastes in before, to pick a figure, 30 to 40 years. That is the minimum amount that the Swedes plan to do. When you do that, of course, it is a much, much easier problem. You can put the rods closer together. You do not have problems with cracking the basalt or the granite or making the salt molten and flowing and all the other multitude of problems which waste heat gives you.

That ought to be done by whatever mechanism, whether by an MRS or onsite storage or whatever because it just makes more sense to cool down the rods before you put them away.

We are going to have a good hearing this afternoon. I am pleased that we have, after a very long absence, Ben Rusche back to testify before us.

Mr. Rusche, we are delighted to have you. Please proceed.

[The prepared statement of Senator McClure follows:]

STATEMENT OF HON. JAMES A. MCCLURE, A U.S. SENATOR FROM THE STATE OF IDAHO

Good afternoon. I look forward to the comments we will receive this afternoon on the Department of Energy's recently submitted proposal for an integral Monitored Retrievable Storage (MRS) facility.

Having just returned from a tour of, among other things, operating MRS facilities in both Sweden and France, I am convinced of the safety and benefits afforded by a central receiving, storage, and conditioning facility for spent fuel. If seeing is believing, I would recommend that anyone even remotely interested in the MRS concept take a look into what is being accomplished by these two countries.

Even though the authors of the original Nucelar Waste Policy Act did not have the foresight to fully appreciate the value of an MRS facility to the overall waste disposal process, the authors at least left that door open so that we could integrate that option into the program at a later date. It now appears that DOE and many members of Congress are convinced of the value of the MRS, and are prepared to move ahead on authorization.

Even though some of the discussions we had during yesterday's hearing might lead one to conclude that onsite storage is an acceptable alternative to a central MRS, I wish to set the record straight that I, for one, appreciate the distinct differences in terms of function, safety, and licensing, between onsite storage and the MRS. I am not prepared to retreat to a default position of having 70-odd defacto storage sites at additional costs and burdens to the nuclear utilities and ratepayers, when the clearly preferable option, from a technical and operational standpoint, is a central facility that can not only store the spent fuel, but also can package and condition the fuel in a cost-effective manner, prior to shipment and emplacement in a final repository. If "best technical option" is what we are striving for, then the MRS is the obvious choice for this nation.

STATEMENT OF BEN C. RUSCHE, DIRECTOR, OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT, DEPARTMENT OF ENERGY

Mr. RUSCHE. Mr. Chairman and members of the committee, I appreciate the opportunity to appear before you today to discuss the Department of Energy's proposal——

The CHAIRMAN. By the way, let me give you an opportunity to clear up that business about the 800 employees who are being opposed by the people in Deaf Smith County, TX. You mentioned to me you wanted an opportunity to set the record straight.

Mr. RUSCHE. Mr. Chairman, I understand there was a question this morning, and I wanted to just note that we have been in intimate contact, very detailed contact, with the folks in Texas in anticipation of our moving folks onsite to begin site characterization later in the year or next year in terms of actual staff work.

As of the moment, we have eight DOE staff and eight Battelle staff, and before the year is over we would hope to have about 42 DOE staff, about 300 staff from Battelle, and about 40 from a technical support contractor, which number will grow to about 800 over the next couple of years.

We have done our best and I think have been faithful to the charge of the act to make the Governor, in a letter I wrote on February 10, 1987, aware of these anticipated plans.

For the members of the local community, there have been scheduled public meetings in the communities to make people aware, and I think that perhaps enough is said to say that not only have we made the folks aware of our intent and have received considerable affirmative reaction but indeed we have already leased spaces for the people in Hereford. We now have two leased spaces of about 10,000 square feet each, and Battelle, who will be the major contractor in the Amarillo area, has a procurement in place and has had indications of interest from about seven or eight firms for 65,000 square feet.

The CHAIRMAN. Will they be hiring local people?

Mr. RUSCHE. Yes, sir. In numbers that I mentioned a moment ago, between 30 and 50 percent of the people ought to be hired from the region.

The CHAIRMAN. You say the local people are affirmative on it, at least some of them?

Mr. RUSCHE. That is my impression. Obviously that many people coming into a small community certainly produces some question with services, and we are working to that end.

I believe this morning you were probably made aware by one of the spokesmen from that community that a novelty, I will call it, in the Act presents a small, though it may turn out to be a significant, problem with our being able to provide certain kinds of impact assistance to special taxation districts.

The act chose to authorize us to make impact and other payments to general taxation districts, and over the next weeks and months it may be worthwhile to consider some adjustment that would give us the authority to deal with special districts which are widely used in Texas and I think are used to some extent in other States.

The CHAIRMAN. To digress further, his concern was also with services, that the serviceability of the local area might be overwhelmed by all these people.

Do you have any plans, or is that a problem? Can you deal with that problem?

Mr. RUSCHE. There certainly are concerns and matters that need to be addressed.

An immediate one has to do with one of the school districts, and others will, I am sure, become apparent. We have authority under the act and are working with the local committees. In fact, I will be meeting with that group tomorrow, and we are going to do everything we can under the law. This particular consideration with respect to authority to make grants to special taxation districts is a factor that we are going to have to get around somehow as a matter of equity.

The CHAIRMAN. That is under the original Nuclear Waste Policy Act?

Mr. RUSCHE. Correct.

The CHAIRMAN. Now, can you make grants under the original Act for things like you come in with 800 people whose children need schooling? Can you make a special grant to deal with the schooling problem?

Mr. RUSCHE. We have some broad authority to mitigate impacts. The questions are two: One, do we have the authority; and two, do we have a reasonable way to measure and determine those impacts. I think the authority is there for general taxation districts. It is not there for special taxation districts.

With respect to the means to measure, I think that is always a question, and it involves the need and the occasion for us to work very closely with the local community. We are inclined to want to do everything we can.

The CHAIRMAN. Would you have your legal staff and your staff look into that question of local services and be sure that you have the authority to deal with that and suggest to us any changes in law that we might make as necessary to deal with that, because it certainly was everyone's intent, and I know it was your intent, whether it is garbage or whether it is schooling, to be able to respond to that need.

Mr. RUSCHE. We will do so, and I certainly appreciate it.

The CHAIRMAN. Let me ask you, before you get into MRS, to clear up just one other thing since it was mentioned. We talked about the sensitivity to local governmental units.

Has DOE tried and will it continue to try to deal with local governments, and have they done their part to seek to bring you into it?

Mr. RUSCHE. I think the answer is yes, we have tried, and I think yes, units of local government generally are more active than broad units of, say, State government because they are more directly affected.

On the other hand, in the law we are, if not forced, at least directed by the language of the law to direct our attention toward the State. I believe that the State governments in all the States that we are working with recognize the importance of working with local units as well.

The CHAIRMAN. How about the State people? Have they been cooperative? They have accused you of not being cooperative. Have they been cooperative?

Mr. RUSCHE. I do not like to make accusations. I would say we still have some opportunities to improve our joint performance in that area and will continue to work at it.

The CHAIRMAN. Just to be frank about it, do you think they are really complaining about the process here or they just do not want the waste?

Mr. RUSCHE. Senator, that sounds like a question that I probably ought to leave for somebody else to answer. I have an impression, but it is not born out of intensive interactions in such a way that I could say would grant confidence.

The CHAIRMAN. Well, in high school debate we used to say omission is admission or silence is admission. So I think I know the answer.

Mr. RUSCHE. I will be very quiet.

The Chairman. Please proceed.

Mr. RUSCHE. Mr. Chairman, almost one and a half years past the time that we were ready and required by law, we now have presented to you the proposal as required by section 141 of the NWPA, a proposal to construct the MRS.

In our proposal, we recommend that Congress approve the construction of an MRS facility at Clinch River near Oak Ridge, TN; limit the storage capacity of the MRS facility to 15,000 metric tons of spent fuel; preclude waste acceptance by the MRS facility until a construction authorization for the first repository is received from the NRC; direct DOE to implement measures responsive to the concerns and recommendations of the State and local governments; and direct DOE to implement the program plan accompanying the proposal.

I would like to summarize what is a fairly lengthy statement.

The CHAIRMAN. Of course, your whole statement will be put into the record.

Mr. RUSCHE. I will try to be brief so we can get to questions.

In December of 1984 DOE initiated efforts to examine MRS as an option for storage of spent fuel consistent with my statement to you at the time of my confirmation and focused on three alternative system configurations.

You will recall that the language in section 141 at least seems to suggest the view was that MRS might be considered as an alternative to permanent disposal, and in my confirmation I raised the prospect at least that I thought we needed to look again at that and that perhaps an integrated system with both MRS and a repository would make more sense.

I obviously did not have the information at that time, and it was after that time that we initiated these studies. The configurations we studied were a system with a deep geologic repository, that is without an MRS; a repository with an integral MRS; and a third system, a repository that would have provisions for an MRS if the repository was not able to proceed, that is as a backup facility.

We concluded that an MRS facility as an integral part of the nuclear waste management system would significantly improve system operations and the timely deployment of key system functions. This approach is significantly different from that, as I mentioned, in the act as a backup facility.

An MRS facility as a part of an integrated system could perform spent fuel preparation and packaging functions at a central location before shipment to a repository for permanent disposal. Performance of these functions at an MRS facility centrally located to the majority of the commercial generators of spent fuel could contribute significantly to overall systems efficiency and timeliness while reducing the total shipment miles.

The east central or southeastern part of the country is central to the majority of nuclear generators and, therefore, the area in which possible candidate sites could be considered.

We considered a number of factors other than geology in the screening for these sites. These factors were: location to minimize total shipment miles in the movement of the waste from its origin to the final repository; ability to judge the suitability of the site for development of a nuclear facility; sufficient available acreage or land; potential to compete with known land use, environmental or other public objectives; and finally, sites at which an MRS facility could be most successfully constructed.

We sought to identify geographic regions within which location of an MRS facility would minimize total shipment miles to the MRS and from the MRS to the repository. We concluded that a region in the east central part of the United States would lower total shipment miles in the concept we were studying, that is to and from the MRS facility, to within 20 percent of the lowest achievable from a theoretical standpoint and, therefore, was preferable under the numerous system logistics options we were considering.

DOE next applied the requirement that the site have 1,100 acres available on which to construct and operate an MRS. This screening factor reduced from 37 sites in 12 States to 11 sites in 6 States. Of these sites, 37 in total, six were owned by DOE and 31 had been docketed with NRC within the preferred region.

We then considered eight additional factors to assess the site's potential for development as an MRS, and I have listed these very briefly as the ease of regulatory compliance; existing environmental settings; geotechnical site considerations; socioeconomic settings; institutional and administrative structure of the State and region; local and regional transportation characteristics; access to physical infrastructure; and capital cost.

Based on this information, in April of 1985 we issued two reports documenting these analyses and identified three candidate sites expected to be included in the proposal for Congress. Mr. Chairman, it has been a long time since any folks have looked at these documents, but I thought that I might just bring them to remind all of us that these documents were published widely. One is entitled "The Screening and Identification of Sites for a Proposed MRS", and the other is entitled, "The Need for and Feasibility of Monitored Retrievable Storage, a Preliminary Analysis".

These two documents were made available at the time we announced our intent to begin consideration of an integrated system.

The three sites identified by this document are all in Tennessee. The Clinch River breeder site owned by TVA is the preferred site, and the two additional sites, one a DOE-owned site on the Oak Ridge reservation, and the third, the site of the now not-being-constructed Hartsville nuclear plant, owned by TVA as well.

Following publication of these drafts and an intensive period of public interaction primarily with folks in Tennessee, a draft proposal was published in December of 1985 which included an environmental assessment, and a program plan. We were prepared to try to have this ready for submission to Congress in early 1986. We had the opportunity, as directed by the Act, to have EPA and NRC both provide formal comments, and concurrently we took advantage of the time and the opportunities we had had to work with the State of Tennessee to seek their comments on the draft as well.

As you are well aware, because of litigation we were unable to submit the report until March 31, 1987. That proposal which I have before me here consists of three volumes and includes the proposal itself in volume one; an environmental assessment, which includes a needs and feasibility study and examines the three alternative sites and six site design combinations as required by section 141; and the third volume, which is the business plan of how we would propose to go about implementing, financing, constructing and operating such an MRS.

We also provided for you comments from the NRC and from the EPA, formal comments from the State of Tennessee indicating former Governor Alexander's general opposition to the MRS. In addition, since that time we have subsequently communicated with now Governor McWherter and have received his view which still opposes the location of MRS and have included it in the package which we submitted to you.

In addition, we included comments from local groups in the State of Tennessee, in particular the Clinch River MRS Task Force of local officials and citizens from the City of Oak Ridge and from Roane County, TN, and I believe you are going to hear from some of these later on this afternoon.

I would like to spend a fair amount of time talking about what I think was an exceptionally effective job on the part of this local task force in doing their job and in working with us, but in view of the fact that you are going to talk with them I will acknowledge that briefly and just pass on.

In addition to the input we received from that local group, subsequently I did receive a report from officials within Morgan County, TN, which is an adjacent county, and they concluded that Morgan County should be considered as a possibility for the preferred site of the MRS. In our proposal that was sent to you on March 31, we included a copy of that report as well, which I think deserves your review and evaluation.

Since the proposal was prepared over a year ago, the Department has revised its estimate of when the first geologic repository can be operational from 1998 to 2003 as we presented in our January 1987 draft amendment to the Mission Plan. The MRS will allow the Department to begin receiving waste by 1998, as we have committed to do in contracts with utilities.

Regarding the draft amendment, volumes one and three of the proposal, the two smaller volumes, were updated and are currently consistent with the impact of the proposed changes that are described in the draft Mission Plan amendment.

In addition, a summary analysis of the effects of those changes were included in volume two. We were attempting to save money, a subject which we had some discussion about yesterday, and did not reprint this very large volume but instead only included a couple of flyleafs to make people aware of the changes that have occurred, another example in which we tried to save a little money.

The CHAIRMAN. We are glad you did that.

Mr. RUSCHE. I did not really intend to spend a lot of time on that subject, but I thought it appropriate in view of our discussion.

You made in your opening comments a statement which I would like to reiterate. In all of the discussions we have had with EPA, with NRC, with the State of Tennessee and with local groups, I think that it is fair to say that safety is not a crucial issue—not in the sense that it is not important—but in the sense that because we are doing work of this sort now and because it can be seen, it is an engineered facility, it does not depend on geologic exploration and confirmation, that all of the comments that we received leave us, and I think can leave you, with confidence that such a facility can be designed and built and provide full and adequate protection of public health, safety and the environment.

In my comments in the full statement, I have noted several quotes from NRC and EPA to that effect. In addition, I have noted additional comments from the State of Tennessee as provided by Governor Alexander went on to point out that he believed that even transportation was not a question with respect to safety. Governor Alexander's views, which will be made available to the committee, I am sure, and now Governor McWherter's views, stress primarily the disadvantage of locating an MRS in this area because of its adverse or possible business effects.

Let me turn to the more specific considerations with respect to the site itself and the program. In the proposal to Congress, we identified the Clinch River breeder reactor site, now currently owned by TVA, as the preferred site. It has several particularly desirable features, including Federal ownership and control by DOE. Under an arrangement with TVA, you will recall that was a site to be used for the once-considered Clinch River breeder reactor.

It has particularly good transportation access, five miles to the nearest interstate highway and direct rail access.

Its site characteristics and current data were judged by the NRC in 1983 as sufficient for granting a limited work authorization for the now-cancelled breeder reactor. This is, indeed, a state of evaluation that is important if time is a factor in our proceeding.

Finally, the technical community in the Oak Ridge area certainly has had experience with nuclear facility support functions.

Building the MRS on a technically acceptable site is of prime importance, and because NRC has already evaluated the site at least for another purpose which appears to be at least as demanding as would be the case for an MRS, we believe that there is very high confidence that the site would be found acceptable. Although there are many alternative sites, almost anywhere, we could locate an MRS because it is an engineered facility located on the surface, we nevertheless are obligated under NEPA and under the NWPA to confirm that that conclusion is indeed valid.

Let me note, if I could, that the Clinch River Task Force, which was a volunteer citizen group, did remarkable work in assessing the safety of the MRS and in developing conditions and suggested mitigated approaches which would make the MRS acceptable to the Oak Ridge/Roane County community.

I am sure you will hear later on today that we have been more or less successful in our attempt to address those suggestions. We believe we have come very close, if not have honored, those proposals, and it is our intent to work as closely as we can with the local community and to the best of our ability accept those recommendations and meet them if Congress decides that we should locate such a facility in that area.

I believe that the effort that has been undertaken in this local/Federal interaction describes a working relationship which could serve as a model for the waste program in all of our State, tribal and local government relationships. We have tried to make that experience available and make other States where we are working familiar with the experience.

Now to the cost of the MRS. Expenditures for the MRS program from the time of congressional approval until the facility becomes operational are estimated at $907 million, of which approximately $710 million would be for construction. The remainder is for final design, preparing the licensing documents, and putting in place the necessary procedural apparatus to begin construction.

The annual operating cost for the facility which would employ about 600 people would be about $73 million, not including financial assistance and tax equivalence payments.

The CHAIRMAN. How many people would it employ?

Mr. RUSCHE. About 600.

The estimates are higher for the initial years of operation, when up to 1,600 sealed storage casks would be fabricated as the storage media for storing the fuel during the temporary storage at the site. The cost would be a little lower in later years when the MRS facility stops receiving spent fuel and is only shipping spent fuel in the canisters for the repository.

Decommissioning would cost about $83 million. Fees add up to a total development, construction, operating and decommissioning cost of about $3 billion. About $2 billion of that is the annual operating cost.

Now, I stress that in the context of the discussions we have had already when you think about CLAB. The numbers that you saw and quoted for CLAB were construction costs for a facility to store 3,000 metric tons. It did not include the design engineering costs. It did not include the operating costs for the period of the operation of the facility. I hope that if I have not been clear enough in questions I can make that even more clearer.

The net cost to the total integrated waste management system would be about $1.5 billion because of savings incurred at the repository and in the transportation system in comparison to a system that had no MRS in it.

The CHAIRMAN. Would you say that again, please?

Mr. RUSCHE. Let me try to be very clear. The direct cost, including all of the factors I mentioned for MRS, is about $3 billion. The incremental cost to the system, that is the additional cost that the waste system would pay, is about $1.5 billion because the addition of the MRS would produce savings at the repository and in transportation of about $1.5 billion.

The cost borne by the utility ratepayers would be thus offset by savings in at-reactor storage costs, which we have not included. These costs would be avoided because an MRS facility would allow DOE to accept spent fuel at an earlier time. Under certain circumstances, it is possible that the addition of an MRS would result in a total or a net cost savings to the overall system.

For example, an MRS facility consistent with the draft Mission Plan Amendment is estimated to eliminate the need for additional storage capacity at more than 15 reactor sites in the period 1998 to 2003 and could offset more than 10,000 metric tons of at-reactor storage. This would result in a savings to the ratepayer of about $1 billion at the reactor sites, based on our current best estimate of that reactor storage being about $100 per kilogram.

Thus, the financial costs of adding an MRS facility, we think, are small in comparison with the benefits. It is estimated that it will take 10 years from the time of congressional approval to completion of construction of an MRS. I have included in my testimony a time line of the major milestones in program elements. I will, of course, leave that for you to study in more detail.

Should Congress authorize an MRS facility, we are committed to seeking within 60 days to enter into a formal consultation and cooperation agreement with the host State.

The CHAIRMAN. Now, let me interrupt you while you are on the subject of cost savings. Would there be a cost saving by virtue of being able to keep your waste longer and cooler, a lesser design characteristic; in other words, more rods per square foot, more tons per acre or whatever?

Mr. RUSCHE. There certainly are some potential savings, and I lump those in the at-repository costs that I mentioned in the difference between $3 billion and $1.5 billion.

You are correct. There would be some cost saving, particularly if we are able to operate the system in a way so that we can optimize both the aging and the age of the material that we ship to the repository.

The Fiscal Year 1988 funding estimate of $58 million which is in the budget before you now for the MRS program assumes congressional approval to proceed with activities that are critical to the deployment of an MRS facility.

Mr. Chairman, I think it is worthwhile to take just a minute to compare systems with and without an MRS, in that that continues to be a subject that we have the opportunity to talk about from time to time.

In considering whether to approve an MRS, it certainly is reasonable to ask what an MRS buys or an integrated system with an MRS buys relative to a system without an MRS. In the first place, and I believe to some extent following our discussion yesterday it was noted, that one benefit which we think is particularly important is that an MRS contributes to our implementation of the entire system by providing a stepwise approach to the integration and completion of the full system.

We would learn licensing lessons. Although they are licensed under different parts, it would be the first waste facility license in the country. We would be able to make early determinations about deploying MRS and know MRS systems as a first step in the process of putting a repository or a waste management system in operation.

A second real benefit has to do with at-reactor storage and consolidation. As I mentioned to you a moment ago, there is a high probability that if the system unfolds as we now project, that between the years 1998 and 2003 there would be about 10,000 metric tons of at-reactor storage required to accommodate the fuel thus generated but which is beyond the capacity of the storage basins at the reactors where generated.

That means new temporary storage capacity would have to be provided at some sites, but it would be much smaller if the MRS were in existence. The necessary incremental storage——

The CHAIRMAN. Excuse me. Why do you use 10,000 tons when the capacity of the MRS is 15,000?

Mr. RUSCHE. The 10,000 derives from the rate at which at-reactor basins would exceed their storage capacity. The capacity of the MRS would be greater than that, but I was trying to make the point——

The CHAIRMAN. Well, that assumes 2003.

Mr. RUSCHE. That is right. That is in the period 1998 to 2003.

The CHAIRMAN. It would be more than that if you are not ready by 2003?

Mr. RUSCHE. Correct.

The necessary incremental storage can be provided at the MRS facility more efficiently and at less cost mainly because a single facility specifically designed and licensed for that purpose would be used instead of many separately designed and licensed independent installations providing both cost, efficiency and, I think, safety considerations.

The MRS facility could allow DOE to begin receiving waste in 1998, and the waste acceptance rates of the waste management system could start exceeding reactor discharge rates about eight years earlier than would be the case than if there were no MRS.

Thus, without an MRS, utilities would have to add significantly more new storage capacity, and they are capable of doing this partly because of programs that we are involved with but partly because of the work that the utilities have been doing on their own. Metal storage casks, concrete storage modules and rod consolidation all offer promise of enhancing or increasing storage capacity beyond reracked pools that have now been racked up to their maximum capacity.

We have worked hard under the R&D program provided in the act to help demonstrate that these technologies are available and are licensable. Through two cooperative programs, two dry storage facilities have been licensed by NRC to Virginia Power and to Carolina Power & Light Co. in the State of North Carolina.

Some have suggested that because utilities can add storage capacity and can consolidate fuel that an MRS is not needed. The ability of utilities to add storage capacity is really not an issue. I think we have demonstrated and they have demonstrated that it can be done. The purpose of the MRS is not primarily for reducing utility storage burden other than to meet the commitments that we have under contracts.

Although reducing the burden is significant, the benefit associated with early implementation of the Federal disposal system, in my opinion, makes the MRS all the more attractive.

On the consolidation question, it is noteworthy that the results of consolidation at reactor sites and consolidation at the MRS are not directly comparable. I have attached to my testimony a very brief graphic to try to make the point.

Generally, at reactor, that is in the pool consolidation, is an effort to take one or two or three, some small number of elements, disassemble and place them in a storage can that is open to the pool of water and thereby enhance the storage capacity in that pool. This is a noteworthy achievement but it is a relatively small achievement in comparison to what we would envision being possible and practical at the MRS.

In the MRS, by contrast, rods from as many as 12 PWR assemblies or 30 BWR assemblies could be consolidated in round canisters at the MRS. These canisters would then be sealed, free of surface contamination, in containers specifically designed for the repository disposal package.

Now, it can and should be said that we have not had full experience in this scale consolidation either, but we do have a very aggressive program in which we are developing hardware at the Idaho National Engineering Laboratory for dry rod consolidation at and of about the type that I have discussed.

In addition, the packaging functions of the MRS facility, in contrast to the reactor storage basins, would be designed, built, licensed and operated specifically for this purpose, optimizing these functions and minimizing the handling and movement of fuel.

Considering that several hundred thousands of assemblies will be consolidated over the life of the program, we believe that it is important that it be done with equipment and facilities dedicated to that objective as opposed to it being an adjunct operation at over 100 different reactor sites not currently licensed for such production operation.

I believe that NRC Chairman Zech, in his letters to Senators Sasser and Gore in response to a question on this subject, pointed out that there certainly is a licensing efficiency if not an overall system value, in consolidating and concentrating this work into one or a few sites. Adding additional operator burdens and complexities at the reactor sites we believe would be inconsistent with the findings that suggest that we need to have a waste system in operation.

Foreign experience further reinforces the Department's belief that existing reactor activities is not warranted. For example, both West Germany and Sweden are minimizing the role of the operating reactors in spent fuel management and disposal in order to allow the reactor operators to concentrate their efforts on safe and efficient operation of the reactor facility.

While no two programs are precisely comparable, the West German and Swedish views of establishing a Federal disposal system with interim storage facilities and permanent disposal in the geologic media make sense, just as does I believe the program now mandated by the NWPA.

I would note as an aside that those of you who had an opportunity to visit the CLAB facility and LaHague, that there are minimal at-reactor storage facilities in both of these countries, the idea being that the existence of this central facility for storing and preparing fuel for further disposal adds operating efficiency and confidence at those reactor systems.

Now, if I can have just a word about transportation. Some improvements in the transportation system should and will be pursued with or without an MRS; for example, increasing cask capacities can reduce the number of shipments. This is being pursued independent of the MRS decision. Increasing the number of reactors that can ship by rail can also yield improvements, and this is being pursued independent of an MRS.

Other suggested improvements have to do with using reactor sites to marshall multicask shipments, performing intermodal shipments, the use of multicask shipments for truck and rail, and the use of extra large casks. All of these are important and ought to be pursued whether or not there is an MRS in operation.

A lot of them remove the advantage of an MRS. They may alter or lessen, depending on how the design finally comes out, the final differential value of an MRS. We believe, though, that the MRS is warranted in spite of or because of such changes.

Now, the cost of an MRS we have projected at about $1.5 billion, I have said, which is about 5 percent of the cost of the Nuclear Waste Fund portion of the entire integrated waste system. I have indicated that some of these costs, perhaps all of them, will be offset by savings in at-reactor storage capacity and savings in the repository system.

I would like to bring my discussion to a close by just reiterating briefly the nature and extent of our interactions with the State of Tennessee between the time we announced in April with these two documents that it was our intent to proceed down this course.

In April 1985, when we announced the identification of three candidate sites for the study of the MRS proposal, we notified the governor by both telephone and letter. At the time of the announcement, we published these two draft documents and sought public comment, requesting that the public provide any available environmental information regarding these sites. We received a number of comments.

To support State participation in the MRS program activities and review of the proposal before it came to Congress, a grant of $1.4 million was provided to the State of Tennessee in July 1985. The State, in turn, made monies available to the relevant local governments, some of whom you will hear from this afternoon.

Copies of the designs and cost estimates were made available to the State as they were completed. The need and feasibility and environmental analyses were developed in conjunction with review and comment from the State of Tennessee and the relevant local governments.

Three meetings were held in 1985 with State officials on the development of the environmental assessment. In response to a request from Tennessee officials, a preliminary version of the MRS environmental assessment was provided to Tennessee State officials and local officials as well as to NRC and EPA in November of 1985.

We received their comments and accommodated them into the three volume review copy of the proposal and supporting documents which were published in December of 1985. The December review copy was used for the official review of EPA and NRC as required under the act. The Department also requested—in recognition of their concerns as the potential host state—that Tennessee review these documents, and they did.

Department officials have participated in 87 workshops, briefings and public meetings concerning or touching on the MRS program from April 1985 to March 1987. Twenty of these were with State officials; 15 were with local government officials; three were travel briefings to acquaint State and local officials with similar government facilities in Idaho, Nevada and New Mexico; and the remainder of the meetings were held by various groups interested in MRS.

The Clinch River Task Force, a group chartered by the city of Oak Ridge and by Roane County, provided a detailed report to the Department in October 1985. This report and letters received from the State provided specific suggestions for improvements in the document's organization, preparation and local conditions for facility acceptability. We believe we have taken these into account, and in fact the proposal is better, much better, as a result of this interaction.

For example, in direct response to State and local concerns, we incorporated the following features in the proposal: a 15,000 metric ton limit on the amount of spent fuel to be stored at the MRS;

We recommended that you provide in law that the repository receive a construction license prior to operation of the MRS;

We incorporated the need and feasibility analysis into the environmental assessment beyond that which we had already done;

We have requested that you, the Congress, authorize mitigation payments for the MRS from start of construction and allow us to make tax equivalency payments starting with the operation of the facility.

Mr. Chairman, I think I have covered——

The CHAIRMAN. Now, you do not need legislation for that, do you?

Mr. RUSCHE. It is unclear because of the relationship between section 141 and other sections of the act as to just where that authority extends and what latitude we have, and we have asked you to provide specific authority if you adopt our proposal.

With that, Mr. Chairman, I think I have probably said all or maybe more than needs to be said, and I would be pleased to take your questions.

[The prepared statement of Mr. Rusche follows:]

STATEMENT OF

BEN C. RUSCHE
DIRECTOR
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT
U.S. DEPARTMENT OF ENERGY

BEFORE THE

COMMITTEE ON ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE

APRIL 29, 1987

Mr. Chairman and Members of the Committee:

I appreciate the opportunity to appear before you today to discuss the Department of Energy's (DOE) proposal for Monitored Retrievable Storage (MRS).

In our proposal, we recommend that Congress:

- Approve the construction of an MRS facility at Clinch River near Oak Ridge, Tennessee;
- Limit the storage capacity at the MRS facility to 15,000 metric tons of spent fuel;
- Preclude waste acceptance by the MRS facility until a construction authorization for the first repository is received from the NRC;
- Direct DOE to implement measures responsive to the concerns and recommendations of the State and local governments; and
- Direct DOE to implement the program plan accompanying the proposal.

Before addressing several of the salient issues surrounding this proposal, I would like to provide relevant background information.

BACKGROUND

Section 141 of the Nuclear Waste Policy Act of 1982 (NWPA) directs DOE to complete a detailed study of the need for and feasibility of, and to submit to Congress a proposal for, the construction of one or more MRS facilities for spent nuclear fuel and high-level radioactive waste.

In addition, section 220 of the NWPA requires DOE to submit to Congress a report describing the research and development activities the Secretary considers necessary to develop the proposal required in section 141. The NWPA required that this report be submitted to Congress not later than 6 months after the date of enactment of the NWPA. In June 1983, DOE submitted this report to Congress, which concluded that the MRS proposal could be prepared using currently mature engineering and design practices without additional research and development.

In December 1984, DOE initiated efforts to examine MRS as an option for storage of spent fuel. DOE considered a variety of alternative system configurations and focused on three in detail. These configurations were:

(1) a deep geologic repository only, without an MRS facility;

(2) a repository with an integral MRS facility; and,

(3) a repository with a backup MRS facility.

DOE concluded that an MRS facility, as an integral part of the nuclear waste management system, would significantly improve system operations and the timely deployment of key systems functions. This approach is significantly different from the concept of the MRS as a backup facility. An MRS facility as part of an integrated system could perform spent fuel preparation and packaging functions at a central location before shipment to a repository for permanent disposal. Performance of these functions at an MRS facility centrally located to the majority of the commercial generators of spent fuel could contribute significantly to overall systems efficiency and timeliness while reducing the total shipment miles. The east-central or southeastern part of the country is central to the majority of nuclear generators and, therefore. the area in which possible candidate sites could be considered.

At approximately the same time, DOE also began its process of screening to identify candidate sites for the proposed MRS facility. This process began with the knowledge of the one major difference between MRS facilities and deep, geologic repositories: MRS facilities, unlike deep, geologic repositories, would be surface facilities and would depend on engineered systems and equipment for the containment of the radioactive material. This makes the safety of such a facility largely independent of the natural characteristics of a site. Thus, suitable MRS sites could be found throughout the country.

As a result, DOE considered factors other than geology in screening these numerous possible sites. These factors, in order of their consideration in screening, were:

(1) location to minimize total shipment miles;

(2) ability to judge the suitability of the site for development of a nuclear facility;

(3) sufficient available acreage;

(4) potential to compete with known land use, environmental or other public objectives; and,

(5) sites at which an MRS facility could be most successfully constructed.

In the first level of screening, DOE sought to identify the geographic region within which location of an MRS facility would minimize total shipment-miles for spent fuel transported through the MRS to a repository. DOE concluded that siting an MRS facility in the East Central region of the United States would lower total shipment-miles to and from the MRS facility to within 20% of the lowest achievable and was preferable under the numerous system logistics options considered by DOE.

Within the East Central region, DOE applied its next two screening factors, the ability to judge the suitability of the site for development of a nuclear facility and suitable acreage. DOE chose to consider those sites within the preferred region, which were either sites docketed with the Nuclear Regulatory Commission (NRC) for development of production and utilization facilities, or lands owned by DOE and used for nuclear activities. The rational for using this selection factor was the very high quality of publicly available data on the suitability of these sites for nuclear development.

Using searches of public literature, searches of the NRC public document room, and professional knowledge of individual sites, DOE identified 37 sites, 6 owned by DOE and 31 docketed with NRC within the preferred region. These 37 sites were located in 12 different states.

DOE next applied the requirement that the site have 1100 acres available on which to construct and operate an MRS. This factor reduced the number of potential sites to 11 sites in 6 states.

The 11 sites were further evaluated, drawing on materials available from public sources. DOE considered eight factors which affected a site's potential for development of an MRS facility:

(1) ease of regulatory compliance;
(2) existing environmental setting;
(3) geotechnical site considerations;
(4) socioeconomic setting;
(5) institutional and administrative structure of the state;
(6) local and regional transportation characteristics;
(7) access to physical infrastructure; and,
(8) capital cost of construction.

Based on this information, in April 1985, DOE issued two reports documenting its analyses and identified three candidate sites expected to be included in the proposal to Congress. The reports are entitled:

The Need for and Feasibility of Monitored Retrievable Storage: A Preliminary Analysis;

o Screening and Identification of Sites For a Proposed Monitored Retrievable Storage Facility;

The three sites identified are in Tennessee: The Clinch River Breeder Reactor site, owned by the Tennessee Valley Authority, as the preferred site; the DOE Oak Ridge Reservation; and the Hartsville Nuclear Plant site.

In December 1985, a draft proposal, including an environmental assessment and a program plan, was prepared for submittal to Congress early in 1986. Copies of the draft proposal were sent to the Environmental Protection Agency (EPA) and NRC for comment, as specified in the NWPA. Concurrently, copies were also provided to the State of Tennessee for comment.

TRANSMITTAL OF THE PROPOSAL

The Department had intended to submit the proposal in February 1986, but was enjoined from doing so by the U.S. District Court for the Middle District of Tennessee in litigation filed by the State of Tennessee. The Department subsequently appealed and received a favorable decision from the U.S. Court of Appeals for the Sixth Circuit overturning the injunction. That decision, in turn, was appealed to the U.S. Supreme Court by the State of Tennessee. The Supreme Court denied certiorari and the Department, having overcome these legal impediments, formally submitted the proposal to Congress on March 31, 1987.

The proposal consists of 3 volumes and, in accordance with the NWPA, it includes the proposal itself (Volume I); an environmental assessment (Volume 2) that examines the three alternative sites and six site-and-design combinations; and, a program plan (Volume 3) that includes plans for funding and for integrating the MRS facility into DOE's waste management system. Site-specific designs, specifications and cost estimates are included by reference in Volumes 2 and 3. Also provided are comments by NRC and EPA. Formal comments from the State of Tennessee, indicating former Governor Alexander's general opposition to the MRS, were received by DOE and were included. In addition, Governor McWherter's position on DOE's proposal, that reaffirms former Governor Alexander's opposition, were also included.

Included in the State of Tennessee comments are those from the Clinch River MRS Task Force of local officials and citizens from the City of Oak Ridge and from Roane County, Tennessee.

This Task Force endorsed the proposal for location of the MRS at the preferred site provided the proposal met certain conditions that the Department believes it has met. Subsequent to the preparation of the proposal and receipt of the State of Tennessee comments, the Department received a report from officials within Morgan County, Tennessee who had studied the prospect of locating the MRS in Morgan County and concluded that Morgan County should be the preferred site for the MRS. The Morgan County report and its recommendations and proposal to the Department are also enclosed for consideration by the Congress. Comprehensive environmental and other site-specific studies would be required to evaluate the Morgan County sites.

Since the MRS proposal was prepared over a year ago, the Department has revised its estimate of when the first geologic repository can be operational from 1998 to 2003, as presented in the January 1987 draft Amendment to the June 1985 Mission Plan. The MRS will allow the Department to begin receiving waste by 1998. Regarding the draft Amendment, Volume 1 (The Proposal) and Volume 3 (The Program Plan) of the MRS proposal submission have been updated to reflect the impact of proposed programmatic and technical data base changes that have been developed by the Department since the proposal was originally prepared. In addition, a summary analysis of the effects of the above changes on Volume 2 (The Environmental Assessment) is included with that volume. The revised volumes and the summary analysis were also reviewed with EPA and NRC staff.

SAFETY DOES NOT APPEAR TO BE AN ISSUE

The MRS uses technology and techniques for remote handling or radioactive spent fuel which DOE and the nuclear industry all over the world have been using safely for many years. In our transmittal of the MRS proposal to Congress, we included comments by NRC, EPA and the State of Tennessee, also concluding that the facility can be safely constructed and operated.

NRC AND EPA COMMENTS

The NRC limited its comments to its role as a regulatory agency and include the following:

> "Siting - The preferred site identified by DOE for the MRS is the site of the former Clinch River Breeder Reactor Plant, which has already been shown to be a qualified site from the standpoint of public health and safety for a nuclear power plant. Moreover, based on present information, the staff knows of no information which would disqualify the alternate sites. DOE, however, has recognized the need for further investigations and evaluation of the designated site as related to the particular characteristics of the MRS design."

> "Design - The MRS conceptual design appears reasonable from the standpoint of public health and safety. Although an in-depth review would be required before the facility could be licensed, it appears from the conceptual design that each requirement in 10 CFR Part 72 can be met."

"Cask Certification - DOE must design a safe and reliable transport system, including durable transport equipment. You have indicated that transport casks developed under NWPA for transporting commercial spent fuel to a repository will be certified by NRC. Based on experience to date, spent fuel can be moved safely in NRC-certified casks."

"Demonstration of Consolidation - The consolidation of spent fuel needs to be adequately demonstrated to assure that this operation can be performed on the production-scale contemplated for the MRS. To date, a few spent fuel assemblies have been taken apart and the rods consolidated, and a significant number of fuel assemblies have been reconstituted (i.e., the rods have been removed and replaced within assemblies). In this sense, the consolidation process is feasible. You have indicated in the Design Verification Plan (Appendix C to the Program Plan) your intent to test and demonstrate disassembly/consolidation equipment, principally at the Idaho National Engineering Laboratory."

"Safeguards - The NRC staff's analysis of the MRS safeguards provisions at the conceptual design stage indicates that all NRC safeguards requirements can be met."

The Department sees nothing in the additional information or staff report detailing its evaluation to indicate that the MRS could not be built in a safe, environmentally sound and timely manner.

The EPA concurred "... that spent fuel and high-level wastes (HLW) can be safely and economically stored in dry storage facilities without significant degradation of the stored materials or risks to the public and the environment...." EPA also stated that "The EA and supporting documentation is adequate in explaining the need and advantages of the MRS as an integral part of the total nuclear waste management system."

Based on their review of the environmental assessment and the accompanying technical documentation, EPA concurred with DOE's recommendation to construct an MRS facility as an important element of the nuclear waste system. EPA further concluded that MRS construction could be accomplished within acceptable regulatory and environmental standards. This determination, however, is subject to EPA review and comment on the Environmental Impact Statement required for construction and licensing (and the subsequent applicable environmental permitting), which will be prepared under the National Environmental Policy Act if an MRS is approved by Congress.

STATE OF TENNESSEE COMMENTS

A few of former Governor Alexander's comments are also worth noting on the point of safety:

" 'MRS' is a REPACKAGING PLANT -- The government has given the plant a ridiculous name (Monitored Retrievable Storage Facility) that confuses almost everyone, and nuclear power opponents have given it an undeserved reputation that scares almost everyone."

"THE REPACKING PLANT CAN BE OPERATED SAFELY -- That, of course, depends upon the U.S. Government's competence as a manager and regulator. But it is the same material being used everyday to make electricity. It will be carried in containers that have never broken, even when test-crashed at 100 miles per hour. The fuel cannot explode and cannot be made into a bomb. More than ninety percent of it will be carried by train, not on highways. The task force of citizens and experts from Oak Ridge and Roane County also conclude that it can be designed and operated safety."

THE CLINCH RIVER SITE

In the proposal to Congress, DOE identified the Clinch River Breeder Reactor site, owned by the Tennessee Valley Authority, as the preferred site. It has several particularly desirable features including: 1) Federal ownership and control by DOE; 2) particularly good transportation access (five miles to the nearest interstate highway and direct rail access); 3) site characteristics and current data judged by the NRC in 1983 as sufficient for granting a limited work authorization for the now cancelled breeder reactor; and 4) a technical community in the vicinity of the site which can provide experienced nuclear facility support functions.

Building the MRS on a technically acceptable site is of prime importance. Because NRC has already determined the Clinch River Breeder Reactor site to be acceptable for a nuclear power reactor, DOE believes there is very high confidence that NRC would find the site acceptable for the MRS, although there are many alternative sites for an MRS. Rather than dwelling on the many good technical merits of the Clinch River site, I would like to address further the non-technical but nonetheless important merits of the Oak Ridge - Roane County community as host for the MRS.

The Oak Ridge - Roane County community is perhaps a unique community in that it has a significant amount of background and experience in (1) working with DOE, (2) understanding and working with nuclear facilities, and (3) having a citizenship which is willing to volunteer its time and effort to work on issues of importance to the local community to ensure that its interests are protected.

The Clinch River MRS Task Force, which was a volunteer citizen group, did remarkable work in assessing the safety of the MRS and in developing conditions and suggested mitigation approaches which would make the MRS acceptable to the Oak Ridge - Roane County community. A measure of the success of this Task Force is the fact that both the Oak Ridge City Council and the Roane County Commission voted unanimously to accept the Task Force results, and would accept the MRS if DOE and the Congress met the conditions developed by the Task Force.

An analysis of the work of this citizen task force is contained in a paper prepared by E. Peelle of the Oak Ridge National Laboratory for the Waste Management '87 conference. I have attached that paper to my testimony (Attachment A) for your information. I believe that it describes fairly a working relationship which could serve as a model for the waste program to use in all of our State, Tribal and local government relationships.

COST OF THE MRS

The expenditures for the MRS program from the time of Congressional approval until the facility becomes operational are estimated at approximately $907 million, of which approximately $710 million would be for construction. The annual operating costs for the facility, which would employ about 600, would be approximately $73 million, not including financial assistance and tax-equivalence payments. The estimates are higher for the initial years of operation, when up to 1600 sealed storage casks must be fabricated, and lower in later years, when the MRS facility stops receiving spent fuel and is only shipping spent fuel in canisters to the repository. Decommissioning would cost approximately $83 million. These add up to a total development, construction, operation and decommissioning cost of about $3 billion.

The net cost to the total system is about $1.5 billion because of savings incurred at the repository and in the transportation system. The costs borne by the utility rate payers would be offset by savings in at-reactor storage cost; these costs would be avoided because an MRS facility would allow DOE to accept spent fuel at an earlier time. Under certain circumstances, it is possible that the addition of an MRS facility would result in a cost saving to the overall system. For example, an MRS facility consistent with the draft Mission Plan Amendment is estimated to eliminate the need for additional storage capability at more than 15 reactor sites and could offset more than 10,000 metric tons of at-reactor storage. This would result in a savings of as much as $1 billion at the reactor sites. The financial costs of adding an MRS facility are small in comparison with the benefits.

It is estimated that it will take 10 years from the time of Congressional approval to completion of construction of an MRS. Table 1 provides a timeline of the major milestones and program elements involved in the MRS deployment schedule.

Should Congress authorize an MRS facility, we are committed to seeking within 60 days to enter into a formal Consultation and Cooperation Agreement with the host State.

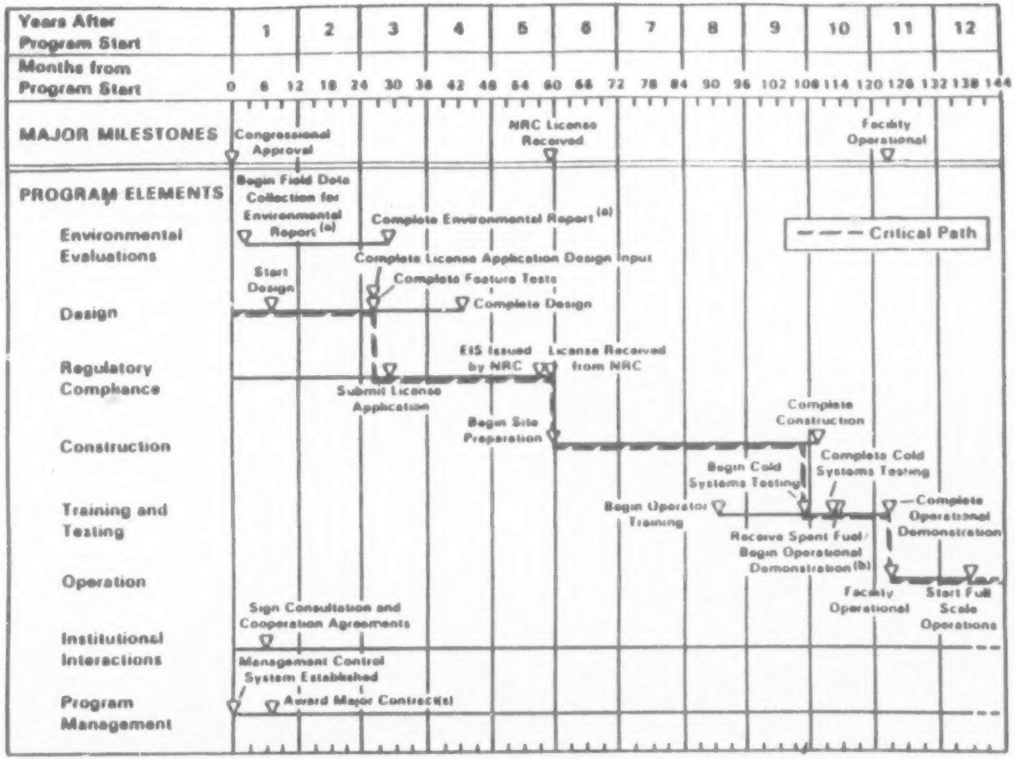
The FY 1988 funding estimate of $58 million for the MRS program assumes Congressional approval to proceed with activities that are critical to the deployment of an MRS facility.

COMPARING SYSTEMS WITH AND WITHOUT AN MRS

In considering whether to approve an MRS, it is reasonable to ask what it buys relative to a system without an MRS. I would like to address this question relative to several of the MRS benefits described in our proposal.

System Development:

One benefit that we consider to be particularly important, is how the MRS can contribute to implementation of the entire system. Inclusion of an MRS in the waste management system provides a stepwise approach to moving from the current state of experience to full scale operation of a disposal system including a repository. Those who compare already deployed MRS and no-MRS system tend to overlook the importance of proceeding with an MRS as a step to a repository.



[a] The precise nature of this document will be dependent on the provisions of any authorizing legislation.

[b] The shipment of spent fuel to the MRS facility is contingent upon receipt of a construction authorization for the first repository. The revised schedule for the first repository in the Draft Mission Plan Amendment contemplates receipt of such authorization by the first quarter of 1998.

TABLE 1 - MRS Deployment Schedule

At-Reactor Storage and Consolidation:

Without an MRS facility, up to 13,500 metric tons of new temporary storage capacity would be needed at about 45 reactors by the year 2003, when the repository would start operating. New temporary storage capacity will have to be provided at some reactor sites in any event, but to a far smaller degree with an MRS facility added to the system. The necessary incremental storage can be provided at the MRS facility more efficiently and at less cost, mainly because a single facility specifically designed and licensed for that purpose would be used instead of many separately designed and licensed independent installations.

The MRS facility could allow DOE to begin receiving waste for disposal in 1998, and the waste-acceptance rates of the waste-management system would start exceeding reactor-discharge rates 8 years earlier than would otherwise be possible.

Without an MRS, utilities will have to add significantly more new storage capacity. They are capable of doing this through such means as metal storage casks, concrete storage modules and rod consolidation. DOE has worked very hard to develop and demonstrate these technologies to help utilities "get by" until the Federal system begins operating to accept waste. Through cooperative programs with utilities, two dry storage facilities have been licensed by NRC.

Some have suggested, however, that because utilities can add storage capacity and can consolidate fuel, an MRS is not needed. The ability of utilities to add storage capacity is not an issue, and the MRS is not proposed with the primary objective of reducing the utility storage burden. Rather, reducing that burden is a very significant, but secondary, benefit associated with early implementation of the Federal disposal system that is permitted by the MRS and that makes the MRS all the more attractive.

On the consolidation question, I wish to point out that the results of consolidation at reactor sites and consolidation at an MRS are not comparable. This is shown in Attachment B. In order to create more storage capacity, some utilities are considering consolidating two assemblies into one square canister that will fit back into the original storage rack.

In contrast, rods from as many as twelve PWR or thirty BWR assemblies could be consolidated in round canisters at the MRS or the repository. The canisters would be sealed, free of surface contamination and specifically designed for the repository disposal package. Thus, consolidation and packaging operations at reactor sites should not be compared to those same operations at an MRS (or the repository). In addition, the packaging functions at the MRS facility (or the repository), in contrast to reactor storage basins, would be designed, built, licensed and operated specifically for this purpose -- optimizing the consolidation and packaging operation by minimizing the handling and movement of the spent fuel. Considering that several hundreds of thousands of assemblies will be consolidated and packaged, the DOE believes it is important that it be done with equipment and facilities dedicated to that objective, as opposed to it being an adjunct operation at over 100 different reactor sites not currently licensed for such a production operation.

The NWPA finds that "a national problem has been created by the accumulation of spent fuel from nuclear reactors" and that the "Federal Government has the responsibility to provide for the permanent disposal". Adding additional operator burdens and complexity at the reactor sites would be inconsistent with these findings which serve as a basis for the NWPA.

Foreign experience further reinforces the Department's belief that existing reactor activities is not warranted. For example, both West Germany and Sweden are minimizing the role of the operating reactors in spent fuel management and disposal, in order to allow the reactors to concentrate their efforts on the safe and efficient operation of the reactor facility. While no two programs are precisely comparable, the West Germans and the Swedes have established a Federal Disposal System with interim storage facilities and permanent disposal in geologic media.

Transportation:

Some improvements in the transportation system should be pursued -- with or without an MRS. For example, increasing cask capacities can reduce the number of shipments; this is being pursued independent of the MRS decision. Increasing the number of reactors that can ship by rail can also yield improvements; this is also is being pursued independent of the MRS.

Other suggested improvements include using reactor sites to marshal multi-cask shipments, performing inter-modal (truck to rail) transfers, use of multi-cask shipments for truck and rail, use of extra large casks (both truck and rail), and use of truck convoying techniques. The conditions under which these techniques are feasible, or even desirable, however, are highly uncertain.

In any event, their only effect on the MRS proposal is to potentially lessen, but not eliminate, some of the transportation system benefits offered by the MRS. Further, they would not help achieve early, route-specific planning efforts that can begin as soon as an MRS site is selected. These include detailed planning with States, Tribes and utilities on such matters as route designation, pre-notification, emergency response, and equipment procurements.

Without an MRS, there are considerable limits as to what can be achieved until a repository site is selected (in 1994, according to the draft Mission Plan Amendment). This illustrates further how an MRS can help resolve issues and make progress earlier, thereby contributing to overall system development.

Cost of an MRS

DOE has projected the MRS would add $1.5 billion, approximately 5% to the costs for the Nuclear Waste Fund portion of the total waste system costs. But the $1.5 billion will be offset by savings in at-reactor storage costs (which are separate from the Nuclear Waste Fund) resulting in utility savings of up to $1 billion. Even without those savings, however, we maintain that what you buy for this 5% is well worth the costs and that in the long run, the MRS may very well result in substantial cost savings that we just aren't able to quantify today.

INTERACTIONS WITH TENNESSEE

In April 1985, when DOE announced the identification of three candidate sites for study for the MRS proposal, DOE notified the Governor by telephone and letter.

At the time of the announcement, the Department published a draft Need & Feasibility Analysis for public comment and requested that the public provide any available environmental information regarding the candidate sites. A number of comment letters were received and responded to by the Department.

To support State participation in the MRS program activities and review of the proposal before Congress, a grant of $1.4 million was provided to the State of Tennessee in July 1985. The State in turn made monies available to the relevant local governments.

Copies of the designs and cost estimates were made available to the State as they were completed. The need and feasibility, and environmental analyses were developed in conjunction with review and comment from the State of Tennessee and the relevant local governments. Three meetings were held in 1985 with State officials on the development of the environmental assessment. In response to a request from Tennessee officials, a preliminary version of the MRS environmental assessment was provided to Tennessee State and local officials, NRC, and EPA in November 1985. Feedback was received and accommodated into the three volume review copy of the proposal and supporting documents published in December 1985. The December 1985 review copy was used for the official review of EPA and NRC as required under the Act. The Department also requested, in recognition of their concerns as the potential host state, that Tennessee review the documents.

Department officials have participated in 87 workshops, briefings and public meetings concerning or touching on the MRS program from April 1985 to March 1987. Twenty of these were with State officials. Fifteen meetings were with local government officials. Three were travel briefings to acquaint State and local officials with similar government facilities in Idaho, Nevada, and New Mexico. The remainder of the meetings were held by various groups interested in the MRS.

The Clinch River MRS Task Force, a group chartered by the City of Oak Ridge and by Roane County, provided a detailed report to the Department in October 1985. This report and letters received from the State provided specific suggestions for improvements in documents organization, preparation, and local conditions for facility acceptability.

Many of the concerns expressed by the State and local governments are reflected in the final documents. For example, in direct response to State and local concerns, DOE incorporated the following into the MRS proposal: a 15,000 MTU limit on the amount of spent fuel to be stored at the MRS; that the repository receive a construction license prior to operation of the MRS; incorporation of the need and feasibility analysis into the environmental assessment; a request that Congress authorize mitigation payments for the MRS from start of construction, and, tax equivalency payments starting with operation of the facility.

CONCLUSION

I urge the Congress to authorize the MRS so that we can proceed with the development of the Nation's integrated waste disposal system in the most effective manner possible.

This concludes my remarks. I would be happy to address any questions you may have.

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ATTACHMENT A

THE MRS TASK FORCE: ECONOMIC AND NON-ECONOMIC INCENTIVES FOR LOCAL PUBLIC ACCEPTANCE OF A PROPOSED NUCLEAR WASTE PACKAGING AND STORAGE FACILITY

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WASTE MANAGEMENT '87
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THE MRS TASK FORCE: ECONOMIC AND NON-ECONOMIC INCENTIVES FOR LOCAL PUBLIC ACCEPTANCE OF A PROPOSED NUCLEAR WASTE PACKAGING AND STORAGE FACILITY

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ABSTRACT

A joint Oak Ridge-Roane County citizen task force (TF) evaluated the Department of Energy's (DOE) proposal to site a Monitored Retrievable Storage facility in Tennessee in terms of environmental, transportation and socioeconomic impacts. The case study examines how the TF used mitigation, compensation, and incentives (economic and non-economic) to address the problem of distrust of DOE and to change the net local impact balance from negative to positive. Intensive group interaction during their investigations and development of trust within the TF led to consensus decisions on safety and conditional acceptance. DOE accepted most of the TF conditions after informal negotiations. The siting process was stopped by extensive state-wide opposition resulting in legal challenge by the state and vetoes by the governor and state legislature.

INTRODUCTION AND OVERVIEW

The innovative institutional arrangements and possibilities for state and local benefits permitted in the Nuclear Waste Policy Act of 1982 (NWPA) have never been fully implemented. This paper presents one example of an effort to site a high level waste facility which opened new ground in public acceptance through citizen evaluation and mechanisms to deal with unacceptable impacts. We describe a case study of a local siting process including negotiation between a potential host area and the Department of Energy (DOE) over a proposed Monitored Retrievable Storage (MRS) facility in the Roane County portion of Oak Ridge, Tennessee in 1985-1986.

The study focuses upon the intensive process by which a local task force (TF) made the decision about safety, evaluated impacts upon the city and county, and specified conditions needed to change the net benefit balance from negative to positive. Unprecedented positive relationships with the local DOE office permitted productive (though uncompleted) negotiations over the conditions which the TF felt were necessary for local acceptance. The effects of participation upon the TF as well as the DOE response to the TF proposals for conditional acceptance of the MRS are examined.

But local acceptance does not a siting make; widespread public and political opposition to the proposed siting developed quickly in the rest of the state, leading to eventual rejection of the MRS proposal by the governor and legislature of Tennessee prior to submission of the MRS proposal to congress. The favorable local climate contrasted with negative reactions to the MRS and the TF report outside the local area. This is a brief version of a longer study and concentrates upon findings and conclusions. For more details and analysis, see the full case study (1). Other perspectives on the MRS siting and its significance include King (2), and Sigmon (3).

The effort to site the MRS is, of course, related to the intense national NIMBY situation with permanent geological repositories. Vigorous efforts by half the states seek to avoid selection, as DOE attempts to fulfill NWPA mandates and site one or two high level nuclear waste repositories. The MRS episode is incomplete, halted by maneuvering over the DOE postponement of second round repository siting efforts. Arguments over the need for the MRS and whether it is a disguised substitute for a repository continue unabated.

As proposed by the DOE in early 1985, a Monitored Retrievable Storage facility would be an integral part of the national radioactive waste management and disposal system. An MRS would receive, repackage, consolidate and temporarily store spent fuel from civilian reactors prior to shipment to a permanent repository, introducing desired flexibility into the waste management system (4).

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OVERVIEW OF TASK FORCE ACTIVITIES

The MRS Task Force was a citizen evaluation group jointly appointed by the City of Oak Ridge and Roane County in Tennessee. Members included local political and community leaders and both technical (including three technical "insiders" with specific rad waste and transportation expertise) and non-technical citizens. Funded for $100,000 by DOE through the State of Tennessee, the task force (TF) organized itself into three study groups--environmental, transportation, and socioeconomic--and undertook an intensive three-month evaluation of the proposed MRS and its impacts upon the local area. Restricting itself to local concerns and impacts, the TF did not consider the question of need for the MRS (5) which was roundly debated everywhere else in the state. The task force concluded that as another untaxable federal project, an MRS would have unacceptable impacts, but that these might be made acceptable if DOE and Congress would agree to numerous conditions designed to mitigate impacts and compensate and reward the area for the role of host. The TF report was unanimously adopted by both local governments and aggressively communicated to political leaders at the state and national level.

Important characteristics of the TF process included open meetings with minutes widely distributed to any who requested. Intense discussion and questioning by both the technical and non-technical members left few questions unasked and were the key to the consensus achieved by the TF. They focused first upon the safety and then the acceptability of MRS operational and transportation impacts upon the social and economic structures of the city and county. Their strategy was to develop conditions under which an MRS would be acceptable, by mitigating and compensating all negative impacts until the benefit balance was positive. DOE was open, responsive and interactive, which led to continuing informal negotiation between DOE and the TF.

SAFETY CONSENSUS DEVELOPED FROM GROUP PROCESS

The task force viewed safety as a non-negotiable precondition to any other arrangements or agreements on the MRS. Two of the TF subgroups were given responsibility for making the judgment on safety (environmental and transportation groups) while the third (socioeconomic) dealt with possible socioeconomic impacts and the conditions that would mitigate or compensate such impacts. The open and intensive questioning by all members and investigations undertaken by the TF strongly influenced group thinking and development of a group consensus. Trips by TF to DOE labs and host areas were highly influential in the decision that the MRS technology could be operated safely. TF concerns thus were focused toward institutional uncertainties and management inflexibility which might affect safe operation of the MRS over its lifetime. The TF wanted guarantees of DOE and government accountability over the long haul. They developed several independent safety-related conditions involving local input and control. The group process thus changed the initial skepticism or opposition of some members by raising questions in a no-holds-barred manner, by aggressively seeking information, formulating questions and evaluating answers, and dealing with concerns in an open manner. Interaction and the development of trust between technical and non-technical members (roughly half each)was particularly important in enabling non-technical members to make the decision on safety. Actuarial assessments of risk or quantative risk assessment thus played a minimal role in the final consensus about safety.

DEALING WITH DISTRUST OF DOE AND GOVERNMENTS

One of the TF's major concerns was how to deal with distrust of DOE, viewed as a principal major impediment to acceptance of the proposed facility. Since media revelations about extensive past pollution of the DOE reservation and DOE's past record of indifference to local concerns were part of the local context, the TF sought to build local trust through performance requirements upon DOE. This included tying the MRS schedule to cleanup of the DOE reservation. Since the long-term reliability and interest of other federal and state agencies was also in doubt, the TF devised various local control measures to assure that those most concerned with the continuing viability of MRS arrangements would be directly responsible for them. These guarantees and safeguards included the citizen oversight board with citizen input to performance standards for the facility and power to shut down the facility if these were violated. In its report (6), the TF also asked Congress to specify how DOE would comply with TF recommendations.

The TF also asked for DOE assistance to help change adverse public perceptions of Oak Ridge as an "environmental disaster" caused by negative publicity about DOE's past record. This included funds for public information about the MRS' true role (not a nuclear dump), DOE's progress in reservation cleanup, and the nature of other DOE activities in Oak Ridge.

TASK FORCE CONDITIONS FOR MRS SITING

The numerous conditions placed upon MRS acceptance by the task force entailed both economic and non-economic conditions, including all the standard socioeconomic mitigations mentioned by the NWPA but going well beyond these (6). Most of the TF's attention was focused upon non-standard impacts of long term management and accountability. Economic mitigations and compensations included tax equivalency of the facility as if it were privately owned from time of authorization (not just construction), property value insurance for homeowners living close to the site, railway and highway upgrading, replacement of the CRBR (MRS) site by an equivalent industrial site, and compensation for loss of industrial diversification possibilities, among others. Equally important to the TF were the non-economic conditions such as additional [illegible]dent safety requirements, local control is[illegible] as a citizen oversight board and local env[illegible] monitoring, assurances that the MRS would [illegible]ne a de-facto permanent repository in the event [illegible] delays in licensing a geological underground repository, and measures to rebuild trust in the performance and trustworthiness of DOE. These and other major incentives and compensations are listed in Table I in the next section along with the DOE response to the TF conditions.

DOE INTERACTIONS WITH TASK FORCE AND RESPONSE TO TF REPORT

Task force members expressed surprise over DOE's responsiveness to TF questions and interests, since this was unlike past local dealings with DOE. But, DOE officials early and repeatedly said they would agree to tax equivalency payments and deal constructively with TF concerns. TF members retained a certain skepticism, however, waiting to see how lasting the DOE attitude change would be and how verbal commitments would be translated into guaranteed arrangements. Extensive personal contact and active discussion between the new local MRS office and TF members developed into an informal negotiation process. The MRS manager forthrightly discussed DOE's problems and limitations in responding to TF ideas and requests. In interactive and informal fashion, the TF proposal as well as DOE responses were shaped. Thus, there were no surprises in the TF recommendations and conditions.

The acid test would be DOE's formal response to the TF report, in the TF's view. A draft of this proposal was reviewed by the TF before formal submission to Congress. It revealed DOE's acceptance in some form of most of the major conditions of the TF (7). Significant differences between the two involved the composition and power of the citizen review board, property value insurance and a linkage of DOE reservation clean up schedules with MRS construction schedules. Significant agreements included tax equivalency payments beginning with authorization of the MRS, the transportation mitigations, limiting MRS storage capacity, and precluding acceptance of any waste by the MRS prior to NRC construction authorization for the first repository. Many DOE proposals, however, require state agreement for full implementation. This concerned local leaders who do not share DOE's assumption that vital local conditions will be adequately fulfilled through a consultation and cooperation (C&C) agreement between the state and DOE. A comparison of TF conditions and DOE responses is shown in Table 1.

This iterative negotiation process ceased in January, 1986, when legal action by the state of Tennessee enjoined DOE from presenting the MRS proposal to Congress until the adequacy of DOE's siting process is reviewed.

FINDINGS

Effect of Participation Upon Task Force Members

The effect of the intensive participation and study upon members included changing the opinions of a significant fraction of TF members, developing a sense pride about their participation and achievements, and achieving consensus not only about safety but also about the conditions of acceptability of the proposed MRS facility. The TF developed its own identity, assuming a life of its own independent of its creators. Initial opinions of those interviewed (13 of 31) about the safety and feasibility of the MRS fell into roughly equal groups of opponents (4), proponents (4) and skeptics or undecided (4). In the end, all voted to approve the report and said their concerns about safety had been resolved. Six months later, one initial opponent would now vote "no," because of recurring doubts about DOE's ability to fulfill its commitments.

Operation of the Task Force

- A citizen task force can be a successful mechanism for lay people to evaluate information and reach local consensus on safety and acceptability of a complex proposed facility. It is an alternative to the increasing but unsatisfactory reliance upon advocacy science.
- A citizen task force is expensive in time, resources and skills requirements. It requires citizen commitment, intensive interaction, and staff support.
- Developer (DOE) funds were critical to task force operation. Though TF members were all volunteers, they could not have completed this demanding operation without in-depth staff and administrative support and travel funds.
- The intensive nature of TF operations was vital to the outcome. A more relaxed operation might not have developed the consensus and group identity needed.

Relations with DOE

- The informal negotiation process throughout the life of the TF led to the development of many conditions acceptable to both sides.
- The task force and the city negotiated the nature of the TF relationship with DOE as well as the specific conditions.
- Task force conditions aimed at changing the institutional relationship between DOE and local governments.
- A basic problem inhibiting completion of negotiations is already apparent: DOE's inability to commit future congresses or other parts of DOE, or to execute direct contracts with local governments.

Siting Process

- Standard socioeconomic impact analysis was irrelevant to the major concerns of the TF which were mostly non-standard assessment issues such as long term management and accountability.
- Legitimacy of a local task force can be enhanced by inclusion of interest group representatives, balanced composition between technical and non-technical members, restraint in use of technical insiders, restricting advance pro or con statements by local authorities or others, and avoiding use of the TF in a promotional role.
- Making the decision on safety requires a minimum level of trust to permit agreement on usable information and thus, to enable negotiation.
- Transferable components of this experience may include the TF's condition strategy, the extra safety measures, some of the process components and the handling of distrust of DOE. Unique aspects and resources of the Oak Ridge area which may limit transferability are a generally supportive local climate, familiarity with large federal nuclear projects, availability of in-house technical resources and expertise, and TF self confidence in its own conclusions and in dealing with DOE.

Problems Shown by State Rejection of the MRS

- MRS siting effort did not meet the criterion that all stakeholders must see some benefit (8).
- DOE used different siting strategies for the state and for the local area. For site location at the state level, it was the old decide-announce-defend (9) approach. For impacts at the local level, they used negotiation.
- Regional and state interest groups did not participate in any joint evaluation and negotiation process as did Oak Ridge and Roane County.
- No local task force, no matter how competent or thorough, can speak for other interests.
- TF insiders improved TF legitimacy with DOE at the expense of legitimacy with the state and region which assumed that the TF was dominated by DOE views.

The MRS and the Nuclear Waste Policy Act

- More attention must be given to local control and power sharing if local acceptance of N-waste facilities is to be achieved.
- Local acceptance is but one part of a complex set of arrangements in a successful siting.
- The NWPA needs revision to allow local negotiation and direct local-DOE contracts. Negotiation by the state on behalf of local interests is unconvincing to local leaders.
- After the state rejected the Roane County site, an

TABLE 1

COMPARISON OF MRS TASK FORCE CONDITIONS
AND DEPARTMENT OF ENERGY RESPONSE

Task Force Conditions	DOE Response
Tax equivalency payments beginning with authorization of MRS.	Accepted. Binding conditions in C&C agreement on valuation formulas, mediation board for disputes.
Local citizen oversight/review board with power to stop accepting waste if pre-agreed standards are not met.	State-level Steering Committee (two local and seven other state, public, industry and DOE representatives). Powers limited to review and suggestion. Chair named by DOE in consultation with governor.
C&C agreements between DOE and local governments in MRS authorizing legislation.	Only state-DOE consultation and cooperation (C&C) agreements discussed.
Property value insurance for nearby residents.	Not proposed.
Mitigate economic development impacts by payments, contractor proximity, location of related private sector activities, and training programs in local educational institutions. Local procurement requirement.	Mitigation payments. Related activities in private sector. Contractor proximity to be selection factor. Training programs through state and local educational institutions. Existing federal procurement provisions.
Diversification of local industrial base.	Will take appropriate actions to encourage diversification.
Location of ancillary DOE and MRS support support activities in Oak Ridge.	Place civilian radwaste transportation system management and new transportation operations and research center at Oak Ridge.
Replace loss of CRBR industrial site.	If land becomes excess to DOE needs.
Public education program on MRS facility, existing DOE programs, and DOE cleanup.	Mitigation payments (MRS only). American Museum of Science and Energy exhibits and information (MRS only).
Highway improvements.	To be addressed in C&C agreement. DOE to work with state and local representatives to identify other improvements needed.
Emergency response training and funding.	Assistance to state for adequate capability, equipment and training. DOE to work with state to develop training standards, will ensure comprehensive training program.
"Gold Star" transportation inspections. Other transportation issues--escorts, methods, intermodal transportation, speeds, preferred routes.	Funding for comprehensive state inspections of spent fuel shipments arriving and leaving. Other issues to be addressed in C&C agreement and in nationwide consultation.
Linkage of DOE cleanup schedule for Oak Ridge reservation with MRS construction schedule.	No commitment made. Explanation of status, plans of current joint cleanup task force (DOE, EPA, state). DOE committed to cleanup as soon as funding and agreement on techniques available.
Complete decontamination and decommissioning of site for unrestricted use at end of life.	Accepted.
Preventing a permanent MRS: Only 300 T. accepted before repository licensed.	No waste accepted until NRC construction license for repository.
Limit storage capacity to 15,000 T.	Accepted.
Overdue storage penalty.	Not mentioned.
Limit storage to 10,000 T before outshipments begin.	Not mentioned.
Low level waste shipped out of state.	Low level waste shipped off site.
Tourism impacts.	Mitigation payments.
Esthetic appearance of MRS.	Accepted.
Visitor center at facility.	Accepted.

adjacent county expressed interest in having the MRS with all the TF conditions plus its own conditions. This development provides unexpected validation of the TF success in changing the net local benefit balance from negative to positive.

- The MRS experience shows we are closer to a viable siting process for controversial facilities, but not there yet.
- Local nuclear waste siting acceptance is doubtful anywhere except in existing nuclear host areas or areas needing the economic benefits.

CONCLUSIONS

The citizen task force process and the conditions required by the MRS TF are a landmark in the nuclear waste siting effort. They provide a new floor to the debate and the arrangements likely to be required by host entities in the future. The TF provided a real world test of the value of compensation and incentive mechanisms in crafting a package of arrangements acceptable to a particular public (10,11, 12). The MRS siting effort also revealed limits to DOE's power to conclude satisfactory negotiation with local governments.

Much more attention must be devoted to local control and power sharing issues. If Oak Ridge and Roane County, an area long familiar with nuclear R&D activities and their management, set such conditions to overcome distrust, will any other locale be satisfied with less?

But, the MRS chapter raises more questions than it answers. Acceptance was achieved only in the local area, while intense opposition arose elsewhere int he state and region. Why did negotitation not occur between DOE and the state? Did DOE try hard enough to negotiate with state authorities? Why did DOE not negotiate the MRS site location as it did local site acceptance? And how should DOE have structured its interaction with state and regional groups?

In the matter of public trust and distrust, how do we get on the road to maybe, as happened in Roane County and Oak Ridge, rather than on the polarized yes-no track followed by the state and the other Tennessee site.

REFERENCES

1. E. PEELLE, "Innovative Process and Inventive Solutions: A Case Study of Local Public Acceptance of a Proposed Nuclear Waste Packaging and Storage Facility," in Symposium on Land Use Management of Rene Dubos Institute for Environmental Management, New York, New York, April 3-4, 1986, Praeger Press (1987) in press.

2. J. KING, "The DOE's MRS Proposal: Responding to Community Concerns," Nuclear News, 29, 59-60 (February 1986).

3. E. B. SIGMON, "Achieving a Negotiated Compensation Agreement in Siting: The MRS Case," accepted for publication in J. Policy Analysis and Management, (1987).

4. U.S. DEPARTMENT OF ENERGY, Office of Civilian Radioactive Waste Management, "The Role of the Monitored Retrievable Storage Facility in an Integrated Waste Management System," MRS-3, (September 1985).

5. E. W. COLGLAZIER, "The MRS: An Assessment of Its Need and Feasibility," Forum for Applied Research and Public Policy, 25-37 (Spring 1986).

6. CLINCH RIVER MRS TASK FORCE, "Recommendations on the Proposed Monitored Retrievable Storage Facility," Roane County and City of Oak Ridge, Tennessee (October 15, 1985).

7. U.S. DEPARTMENT OF ENERGY, Office of Civilian Radioactive Waste Management, "Monitored Retrievable Storage Submission to Congress, Proposal for Construction of an MRS," Vol. 1, Draft, DOE/RW-XXXX (December 1985).

8. T. COTTON, "The MRS Facility: Radioactive Waste Management at a Crossroads," Forum for Applied Research and Public Policy, 10-24 (Spring 1986).

9. D. DUCZIK, "Citizen Participation in Power Plant Siting: Aladdin's Lamp or Pandora's Box?," American Planning Association Journal, 154-166 (April 1981).

10. S. CARNES, E. COPENHAVER, J. SORENSEN, E. SODERSTROM, J. H. REED, D. BJORNSTAD, and E. PEELLE, "Incentives and Nuclear Waste Siting: Prospects and Constraints," Energy Systems and Policy, 7, 4, 323-351 (1983).

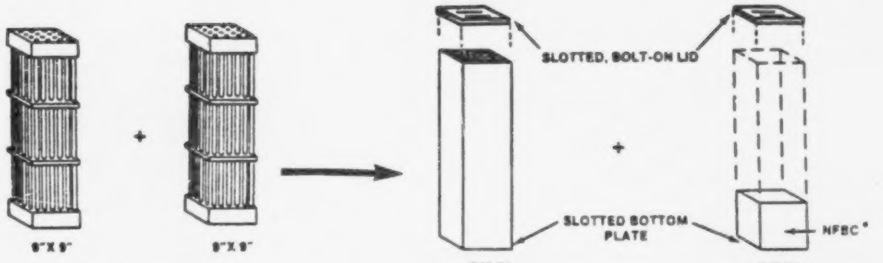
11. J. SORENSEN, J. SODERSTORM, and S. CARNES, "Sweet for the Sour: Incentives in Environmental Mediation," Environmental Management, 18, 287-294 (1983).

12. E. PEELLE and R. ELLIS, "Hazardous Waste: Are There Ways out of the 'Not-in-My-Backyard' Impasse?," accepted for publication in Forum of Applied Research and Public Policy, (1987).

ATTACHMENT B

CONSOLIDATION COMPARISON

AT-REACTOR*



- TWO INTACT ASSEMBLIES
- ONE SQUARE CANISTER
- FILLS A PORTION OF AN NFBC CANISTER

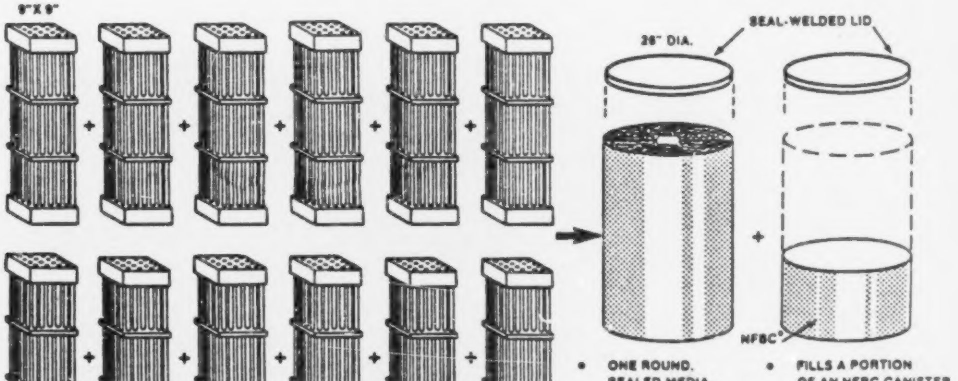
NOTE:

OPEN (NOT SEALED) FOR WATER COOLING, MAY HAVE TO BE RECONFIGURED FOR DISPOSAL

SAME DIMENSIONS AS AN INTACT ASSEMBLY TO ALLOW RE-INSERTION IN RACK

CONSOLIDATED IN OPEN POOL, UNDER WATER (DIRECT VIEWING IS DISTORTED)

MRS*



- ONE ROUND, SEALED MEDIA-SPECIFIC CANISTER
- FILLS A PORTION OF AN NFBC CANISTER

TWELVE INTACT ASSEMBLIES▼

NOTE: CONSOLIDATED IN CLOSED, SPECIALLY DESIGNED HOT CELL WITH DIRECT VIEWING

* PWR FUEL FOR ILLUSTRATION PURPOSES

▼PROJECTED SALT DISPOSAL CANISTER AND LOADINGS FOR ILLUSTRATION PURPOSES

* NFBC: NON-FUEL-BEARING COMPONENTS OF ASSEMBLIES (e.g. END FITTINGS, GRID SPACES, GUIDE TUBES)

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The CHAIRMAN. Thank you very much, Mr. Rusche. Would you tell us about the design of an MRS, physically what you proposed and just how you plan to operate it.

Mr. RUSCHE. The MRS perhaps is described best as a relatively large above ground building of several stories, large enough to accommodate handling facilities for radioactive fuels.

These would be remotely operated cells, in which fuel could be manipulated by remote control, mechanisms for receiving and opening casks, for consolidating fuel, for keeping account of the fuel, for providing safeguards and protection, and for consolidating that fuel, and finally putting it in a clean package ready for storage and subsequent shipment to the repository.

So what one would see would be a relatively large industrial looking building of several stories, several hundred feet in extent on each side. Adjacent to this facility would be the necessary support facilities, like an administration building, several support facilities, and in particular a facility to produce the concrete casks for storage.

Then subsequently and adjacent to that would be a large parking lot. A paved or hard surface lot or area on which individual storage casks containing perhaps as many as 20 or more fuel assemblies would be placed and would be monitored by instrumentation and would be stored for as long as is desired to serve the purpose of the MRS.

The CHAIRMAN. Now you have this attachment B here which shows that 26 inch in diameter media-specific canister. Is that what you have in mind?

Mr. RUSCHE. That is a good example of the difference between consolidation of an at-reactor consolidation effort and the MRS.

The canister at the MRS was designed to match whatever medium was subsequently chosen for a final repository, so that that canister, when sealed at the MRS, would then need only be transported and eventually emplaced in the repository.

The CHAIRMAN. So it would not be unsealed.

Mr. RUSCHE. No, sir. It would be sealed in the canister, and then sealed in the storage container.

The CHAIRMAN. Now, what kind of canister, you say that would have to be media-specific?

Mr. RUSCHE. Yes, sir.

The CHAIRMAN. And you say copper canisters do not work in salt?

Mr. RUSCHE. That is correct.

The CHAIRMAN. But they may work in another medium.

Mr. RUSCHE. It might. We are looking at copper, stainless steel, various kinds of stainless steel, at carbon steel. Some of the environments even suggest carbon steel would be a suitable and perhaps a preferable package.

The CHAIRMAN. Now, you have the canister sealed up, and then what do you do with the canister?

Mr. RUSCHE. You insert the canister in a large concrete cylinder.

The CHAIRMAN. And how big is the cylinder?

Mr. RUSCHE. I would guess it is about six feet by 20 feet. It weighs about 220 tons, maybe 12 feet in diameter and 20 or 25 feet high.

The CHAIRMAN. Is that buried or parked on the parking lot?

Mr. RUSCHE. Parked on the parking lot, just a bunch of cylinders sitting there.

The CHAIRMAN. But you put that, let us say, steel canister or copper, whatever it is, into that and you put a plug on the top of that.

Mr. RUSCHE. And seal that.

The CHAIRMAN. And seal that. And then people can walk around.

Mr. RUSCHE. Indeed they could.

The CHAIRMAN. Just as you can walk on top of the waste at Marcoule.

Mr. RUSCHE. Yes.

The CHAIRMAN. How much concrete does it take to seal up against those wastes? Four feet, something like that?

Mr. RUSCHE. It is about three or four feet.

The CHAIRMAN. So you have four feet of concrete, essentially, into which you put your——

Mr. RUSCHE. Yes. Now you remember that, in fact, in the proposal we noted that we looked at below grade storage; that is, make a trench in which you put these same sort of monoliths. And from a practical standpoint it makes really no difference.

It may be more aesthetic not to have them sitting above grade, but it certainly costs more. And since it does not provide a real benefit, we elected to recommend the above grade, that is just sitting on the surface.

The CHAIRMAN. All right. Why do you need 1,100 acres for this site?

Mr. RUSCHE. We actually need about 300 to 400 acres for the planned use, but we thought it wise to have access to sufficient land to provide flexibility should additional use be needed.

The CHAIRMAN. I see. Well, at Marcoule and La Hague, they had much less space than that.

Mr. RUSCHE. Much of that is because they were storing in water, if you recall. Dry storage provides the kind of convective cooling that you were referring to yesterday at AVM, which is the in-the-floor storage that you saw.

The CHAIRMAN. Now is this natural convection?

Mr. RUSCHE. It is out in the open air. Natural convection. The size and load of the fuel that you put in a particular cask is such that it will be cooled by such convection cooling. It needs no forced cooling, no external treatment.

The CHAIRMAN. Do you need to age it at all before you put it in those canisters?

Mr. RUSCHE. Well, there is a design parameter that says a cask of this dimension and this size is suitable for this much fuel of this heat generation rate. So either you age it or put less in the cask.

The CHAIRMAN. Now the French and the Swedish pointed out the advantage of their interim storage program, that the design characteristics of their permanent repository could be much less demanding once the waste has cooled down for a period of, I think they had in mind about 40 years. And that is true in your program as well, is it not?

Mr. RUSCHE. The answer is, I think the answer is yes. That is, that fuel that is older presents a smaller heat load, and therefore would allow design variations in the repository.

But I would note that we have two statutory requirements that we are obligated to meet. I believe under the Energy Reorganization Act of 1974, we are obligated to be prepared to receive fuel as young as five years of age. We have chosen as a design basis 10 year old fuel.

The CHAIRMAN. That is in a repository?

Mr. RUSCHE. For the repository. If you look at the amount of fuel that is now present and the age of fuel that will be in existence at the time MRS or the repository would go into operation, and then attempt to project the age of fuel that will be inserted either into the MRS or the repository over the first 20 or 30 years of its life, the average age of that fuel is between 25 and 30 years.

The CHAIRMAN. Well now can you take that into consideration in the design, or is there some statute or some rule somewhere that makes you design it for five years?

Mr. RUSCHE. You take it into account, but it is relatively straightforward to take into account. For example, if we chose, let me just use the example, if we chose 10 years, that would mean in the simplest sense that canisters carrying a certain amount of heat would be placed a certain distance apart in the medium.

If we found that for some reason fuel that was going to be provided was older than that, that its heat load was lower than that, then as we are constructing the repository, you do not construct all of the holes in the repository before you put anything in it, you construct a few holes to emplace the fuel so you are continuing to construct the repository while you are loading the repository.

The CHAIRMAN. There would be no constraints in the size of the cavern or anything like that.

Mr. RUSCHE. No, you would just make the adjustment as the situation unfolds. To design the repository, though, from the standpoint of licensing considerations, it is necessary to develop a base design, or a reference design, against which these kinds of considerations can be evaluated.

It means that if you find a circumstance that is less challenging than that, you can always use that circumstance. But you would not use a more challenging circumstance.

The CHAIRMAN. So NRC would have full flexibility to take those things into consideration.

Mr. RUSCHE. I believe that is correct, without doubt.

The CHAIRMAN. All right. You pointed out that essentially that this is a parking lot, by the way is it under roof, the parking lot?

Mr. RUSCHE. We do not envision it being under roof. We could put one up if people wanted to spend more money. But it is not worthwhile. The casks are large monoliths that are not vulnerable to anything from the elements, protect the public, and nothing like that is needed.

The CHAIRMAN. I know the answer to this, but let me give you an opportunity to say it again. What are the dangers from this? You have this parking lot out there. Can it explode? Can it flow away, melt down into the water supply? Can it turn into hydrogen gas and have an explosion, or radon? What are the dangers?

Mr. RUSCHE. The dangers are very close to zero. And that is true because the energy content of the fuel that is stored in these containers is so low. The fuel, if put in the air, by itself, would not melt, would not be damaged by lack of cooling, for example.

The value of dry storage is that it is completely passive. It does not depend on power, or circulation, for heat removal. It is stored under a method which means that the heat, whatever it is, however small or large it is, if acceptable in this circumstance, does not have the potential for melting the fuel.

It does not have the potential, if the cask were to turn over by some means, for example suppose an airplane were to fly into it. I expect the airplane would suffer the majority of the damage in that these 12 foot diameter concrete monoliths are relatively large objects, weighing 200 tons or so.

They are invulnerable to the elements. And in addition they are monitored. If one of the fuel elements for some reason should begin to leak a small amount of radioactive gas, it would be determined, the cask could be brought into the MRS and opened up.

The CHAIRMAN. Now when you say the chance is almost zero, I want to be clear on this, let us say there is a 1 in 1 million chance of something. What is that? A meltdown? An explosion? Or what?

Mr. RUSCHE. I believe the most unfavorable consideration we could think of would be one in which by some unknown means the cask were just opened up and the fuel that was then stored in it were laid out on the ground.

If the fuel were laid out on the ground and a person came close to it, the inherent radiation from that material would be very hazardous. It would stay there until you did something to it.

The CHAIRMAN. Somebody over in Oak Ridge now, she is a housewife putting out the laundry, and a plane crashes into it and several casks are opened up. And she is out there in the open air, what happens to her? Let us say she is half a mile away.

Mr. RUSCHE. She will probably see smoke and perhaps a burst of fire from the fuel and then the airplane igniting. There should be no radiation effect following that.

The CHAIRMAN. So, in effect, the chances of somebody in Oak Ridge getting hurt from the existence of this repository are virtually nil, if the very worst happened. It is not a great disaster. The danger would be if somebody came very close to it.

Mr. RUSCHE. Correct. It is proximity that would produce a potential hazard, and in fact the primary effect from a health and safety standpoint is to the workers. The effect is still very small. But in working with such fuel assemblies, moving them around, consolidating them, like the work we do at Idaho now, the primary potential hazard, though very small, is greater to the workers than it is to the public.

The CHAIRMAN. Now you have got in effect 600 or so sites where nuclear rods are stored now. What has been the health history of those workers who worked among the 600 places where you already store these rods?

Mr. RUSCHE. We have a few less than that. We have about 106 reactors that are now operating at about 65, 70 sites.

The CHAIRMAN. Excuse me, I do not mean 600, I mean 60.

Mr. RUSCHE. At the reactor sites the situation is different, because when the fuel comes from the reactors, when it is five minutes old, it still has a heat generation potential for producing damage to itself, thereby liberating, making available to the atmosphere the contents of the fuel elements.

After they have aged for some period of time, and in general that period of time is probably 10 years or greater, that potential becomes very small. That is, you could have the elements hanging in the air, and they would not, because of their own heat generation, destroy themselves.

The CHAIRMAN. Granted, but how many people have been killed by fooling with it?

Mr. RUSCHE. None, to the best of my knowledge.

The CHAIRMAN. How many have been injured?

Mr. RUSCHE. Well, I suspect that some would say that radiation exposure at levels that are greater than part 20 exposures would amount to some injury. Those numbers are still quite small, but there have been people who receive radiation doses that are several times the kind of doses they receive for xrays from medicine.

And there have been a few exposures that have been large enough in the history of the entire industry to produce measurable health effects. And I believe there have been two or three deaths, not from the handling of fuel of the type that we are talking about, but in conjunction with experiments and reactors.

The CHAIRMAN. So there have been no deaths from handling of fuel?

Mr. RUSCHE. In the storage mode we are talking about.

The CHAIRMAN. That is right. That is what we are dealing with here. And there have been how many serious injuries that you can——

Mr. RUSCHE. I do not have a firm number, but it is a few. The number that I recall is on the order of six or eight. I would be glad to give you more precise numbers with more confidence.

[The information follows:]

The safety record of the nuclear industry with respect to the handling of spent fuel for storage purposes has been very good. Although the Department does not keep its own records regarding the safety of the nuclear industry, information acquired from the NRC (U.S. NRC Inspection and Enforcement Bulletins No. 78-08, 1978 and No. 82-31, 1982) indicates that since the start of the nuclear industry in the 1960's, there have been a total of three workers who have received occupational overexposures due to the handling of spent fuel at reactor sites. Whether or not an occupational overexposure results in injury is dependent on a variety of factors related to the specific individual and the type of radiation exposure involved. Regarding your question concerning the safety of the MRS, the design of the MRS is intended to incorporate the latest advances in the technology of handling spent fuel to minimize the risk of radiological occupational exposure and exposure to the public at large.

The CHAIRMAN. But this is an even less danger than that, is that correct?

Mr. RUSCHE. The MRS? Without question.

The CHAIRMAN. I know this is very elemental. But there are millions of people out there who do not understand it, and I want to try to make it as clear as I can.

One final question, and I am sorry to go so long for my colleagues here. I do take it that other sites could be considered, and I might say that there are, I have heard of two other areas, and I am not going to tell the press who they are, but I do know at least two other sites that have at least some interest in trying to dislodge Oak Ridge from their preferred position. But could other sites be considered?

Mr. RUSCHE. Indeed so. I think there are two factors that one would take into account. To achieve the locational advantage, they would need to be in the south-central part, the southeastern part of the country that would present the transportation benefits that we have talked about.

Other than that, all you need is a piece of fairly level ground, of ground that can be made level with reasonable load bearing properties.

The CHAIRMAN. Thank you very much. Senator McClure?

Senator MCCLURE. Thank you very much, Mr. Chairman.

On page 4 of your prepared statement, you indicate that DOE identified 37 sites, 6 owned by DOE and 31 docketed with NRC within the preferred region. These 37 sites were located in 12 different states.

Has there ever been a public discussion of where all of those sites were or are?

Mr. RUSCHE. Yes, Senator. In our document DOE RW-0023 entitled, "Screening and Identification of Sites for a Proposed Monitored Retrievable Storage Facility", we have described each of those sites, what their current condition is and what their pros and cons were.

Senator MCCLURE. In the next paragraph you indicate that the site size requirement, the 1,100 acres requirement, reduced that number of potential sites to 11 in six states. Is that similarly identified?

Mr. RUSCHE. It is part of this document here. I would be glad to provide a copy for you or for the record.

Senator MCCLURE. Thank you. I wonder if you would provide one for the Committee. It can be placed in the Committee file.

Mr. RUSCHE. I would be delighted.

[The document was retained in committee files.]

Senator MCCLURE. Thank you. One page 5 of your statement, you list eight factors which affect the site's potential for development. Just running down through those eight factors, and you have your statement before you, without reading them, items no. 1, 2, 4 and 5 are at least in part based upon political factors. Are they not?

In other words, the acceptability or the reaction of individuals or governments that may be affected?

Mr. RUSCHE. I would say that 1 and 2 are not related in that manner, Senator.

Senator MCCLURE. Ease of regulatory compliance, you are not looking at——

Mr. RUSCHE. We were looking at experience, such as the fact that in the case of Clinch River the NRC had already issued a limited work authorization, so we could have confidence that it would be easy to get or not very challengable.

Senator MCCLURE. That is on physical factors?

Mr. RUSCHE. Yes. Safety and physical factors. Certainly item 5——

Senator McClure. And 4?

Mr. Rusche. Four, to some extent. If not political, then certainly socio-economic factors.

Senator McClure. You label them as socio-economic and I was trying to get the other terminology, because I might understand it better. You are talking about public and institutional reactions.

Mr. Rusche. Correct.

Senator McClure. I noticed that the task force suggested, if I read it correctly, that tax equivalency be paid from the time of authorization.

Mr. Rusche. Correct.

Senator McClure. I believe your recommendation is that mitigation payments be made from the start of construction and tax equivalency payments starting with operations.

Mr. Rusche. Correct.

Senator McClure. What is the difference between the two?

Mr. Rusche. Monetarily, they would be not very much different. But it seems that without a structure to tax, it would be better to think of the activities in advance of construction, in terms of mitigation activities.

Senator McClure. I think it may be well for us to note that the value of an MRS to consumers of utilities that would be providing the waste needs to be considered in the context that a tax is already being levied on them for the development of a waste repository. Is that not correct?

Mr. Rusche. That is indeed correct.

Senator McClure. So they are paying for something whether they are getting something or not.

Mr. Rusche. They are paying for something which they hope to get at a later time.

Senator McClure. And if they do not get it they will be paying for something twice. They will be paying for what they did not get and they will be paying for what they must have in terms of at-site storage.

Mr. Rusche. I believe that is the way the law is written.

Senator McClure. It seems to me that if I were concerned about the benefit to the consumers of those utilities, I would be trying to get something done with that money that would relieve them of the necessity of paying twice.

Mr. Rusche. We believe that there is considerable merit to that argument.

Senator McClure. I thought perhaps you might. I feel compelled just to give you the opportunity to respond to a statement that has been made that there is an unreleased GAO report that has been requested but not yet completed.

The statement says that DOE has failed to demonstrate to Congress the need for an MRS, and may have significantly underestimated the costs of such facilities. Would you care to comment about that draft General Accounting Office report?

Mr. Rusche. With respect to the second point, that is of our underestimation of the costs, I believe the cost estimates we have reflect the best information that is currently available on the basis of a conceptual design done.

We have spent about $35 million to get to this point, and I believe that investment has produced a set of specifications and designs which do provide a reasonable basis for cost estimates. So I think the second question we would believe is unwarranted.

With respect to the first one, I cannot tell whether Congress will have enough information to make a choice or make its decision or not. We believe that what we have provided, in the volumes that I have before me and which you now have before you officially, the information requested in the Act, plus more, and that indeed there is an adequate basis for Congress to make the decision.

I am not sure that the GAO or DOE, either one is in a position to make a judgment. It seems to me that judgment in the end has to be made by the Congress itself.

Senator McClure. Let me make just this much statement by way of history, because I think people reading records sometimes can misconstrue what the record reveals, if indeed they do not know the context of the discussions and decisions made at some point in the past.

When Congress was developing the Waste Policy Act there was a debate in this Committee as to whether we should go to geologic storage or whether an MRS was the appropriate way to go. I think it is fair to say a substantial body of opinion in this Committee favored the MRS.

A substantial body of opinion in the Committee on the Environment and Public Works wanted to go directly to geological storage and the majority opinion in the House of Representatives favored geological storage.

The Senator from Louisiana, now the chairman of this committee, was one of the strongest proponents of an MRS, as I recall. And after the discussion we had in this committee and on the floor of the Senate and in conjunction with the House of Representatives in fashioning the law, we wrote the provisions which we now see in terms of a study and report to the Congress.

I recite that only because this Senator involved in that process has always believed the MRS to be the better final result, for a whole variety of reasons, not the least of which we covered partly yesterday in terms of the ethical and economic considerations with respect to the waste of potential energy in the natural resource.

I can not believe that we will as a nation decide that when we mine uranium ore we should use 1.5 percent of its potential energy and throw the other 98.5 percent away. That is not in my view either good ethics or good economics. And I believe very strongly that an MRS fits more aptly into developing science, technology and public attitudes and policy than does permanent repository storage.

I am pleased that you are here before us, suggesting that an MRS makes sense, that we ought to get on with it. And we can look at the other question, and I very firmly believe, Mr. Chairman, that we ought to get on with the MRS while we look at the other question and work through the problems with respect to the geological storage.

I do not see why we should hold up on MRS while we await the other. Although I do know that the two are linked very closely in political perceptions. But I really do hope we will take actions to support, confirm and extend the actions which you have taken. I wish to commend you very strongly and I want to second the commendation you made with respect to the task force.

I think the local task force, from whom we will hear later, did a good job. They did a balanced, reasonable, informed and intelligent reaction to the problems. And I suggest that the people that know the most about it and are closest to it perhaps ought to be listened to. Thank you very much, Mr. Rusche.

Mr. RUSCHE. Thank you, Senator.

The CHAIRMAN. Senator Ford.

Senator FORD. Thank you, Mr. Chairman. I have always listened with great interest and admiration to my distinguished friend from Idaho, and every once in a while I find him something like the fish in his clear stream.

They are swimming upstream every once in a while, but I think maybe he is about arrive to help us arrive at a consensus. Because I believe that is where we are going, that there be no geological storage eventually and the MRS is the right way to go.

But I have developed, Mr. Rusche, in the last couple of days somewhat of a cloud over this whole thing. I thought I had my mind reasonably made up. But you try to keep enough open if there is new evidence and new information coming forward that you are not fixed in a 4-feet square concrete block.

But in listening, if I get the message, that to reprocess this spent fuel, that if you go beyond three years, it probably will not be useful. That was his testimony I think yesterday after it has been stored for 3 years. Did I get that information yesterday from Dr. Weinberg?

Maybe I missed it somewhere. But I asked him, in what time frame you would go to reprocessing, I thought. And he said, anything beyond 3 years.

Mr. RUSCHE. I do not remember that exchange. Perhaps I can try to illuminate the question a little bit.

Senator FORD. You were sitting right there in that first row. Maybe I misunderstood him or maybe I did not ask the question right.

Mr. RUSCHE. I did not understand that question precisely. Maybe if you would ask me the question and let me try again.

Senator FORD. Well, come at me.

Mr. RUSCHE. My recollection is that Dr. Weinberg was responding to a question about the age of fuel, not whether it was either practical or desirable to reprocess it. I think that he was pointing out that, and I am really digging out of my memory the three year statement——

Senator FORD. They tell me after 25 you begin to lose a little bit of it. I think you and I both have arrived.

Mr. RUSCHE. I have noted that with increasing frequency.

Senator FORD. And the name is the first thing to go. Do not let anyone kid you.

Mr. RUSCHE. Sir, I did not get your name. Let me try to make a statement that may illuminate the subject a moment.

On the subject of reprocessing I think the general comment was that there is a large amount of energy potential left in the fuel. Senator McClure made that comment a moment ago. And the question I believe went to why are people not reprocessing in the United States.

The general response that I would make to that is that it is primarily an economic question.

Senator **Ford**. Yes, I got that.

Mr. **Rusche**. That is that there is cheap uranium to be mined in our neighboring countries and in the United States to some extent. And it is just not economic. You can store the fuel for as long as you care to.

And if you ever want to go back and reprocess it for its energy content, that is for the remaining uranium or the plutonium that is fissionable, then you can do that essentially at any time that you can get to it, whether it is three years or 30 years or 100 years.

So in that sense the time you keep it does not cause it to deteriorate in value. It is true that the older the fuel is, the easier it is to handle the fuel.

Senator **Ford**. I understood that. That was one of the points he was making. But the point I was trying to get from him, so I am glad that I asked the question to clear it up, I asked him how long could the spent fuel be left in storage, I thought, before it would not be appropriate to reprocess?

And I understood him to say, approximately 3 years.

Mr. **Rusche**. I believe he did not answer that question, and the answer is——

Senator **Ford**. I will go back and look at the record of yesterday and see how we come out, because she is better at it than we are.

Now one other thing that bothers me, Mr. Rusche. I have a feeling there may not be a repository. And I get the feeling for a couple of reasons. One, you have got expanded space and you talk about a large number of acres, and I think that was to do other things that might come along, and I kind of got that the other things that might come along would be to expand the MRS.

And then when we look that your repository would be 10 years, you figured it at 10 years in the MRS, moving 10 years. Is that what you said?

Mr. **Rusche**. I said it would take 10 years from the date Congress authorized the MRS for us to go through the process of licensing and construction. So 10 years from the date that you authorized it we ought to be able to put the MRS in operation.

Senator **Ford**. Well, I am not listening right.

Mr. **Rusche**. I believe that is the only reference I made to 10 years.

Senator **Ford**. But you talked about 10,000 tons.

Mr. **Rusche**. Correct. 10,000 metric tons.

Senator **Ford**. Which are 2,200 pounds. Right? Per ton?

Mr. **Rusche**. Correct.

Senator **Ford**. Then you talk about 15,000 metric ton capacity.

Mr. **Rusche**. Correct.

Senator **Ford**. Then we are talking about keeping it longer than you expected in the beginning. And maybe you will let it cool off a little longer. We are beginning to talk about 30 to 50 years now.

Mr. **Rusche**. Yes.

Senator **Ford**. That indicates to me that MRS will not have sufficient space to hold all of the spent fuel. If you begin to look at 30, 40 or 50 years, and you are going to be looking at expansion rather than movement.

Mr. RUSCHE. May I speak first to the proposal?

Senator FORD. Sure.

Mr. RUSCHE. The proposal, that is for you to authorize a capacity of 15,000 metric tons, which is about five or six years direct output from the discharge of reactors at that time. The 10,000 metric tons that we talked about was the amount of at-reactor storage that could be avoided in the five year period between 1998 and 2003.

That is the time between the MRS would come into the operation, if the proposal is accepted, and 2003, the date in which we project the first repository to be in operation. That is the origin of those numbers. Let me be sure I have gotten those straight.

The 15,000 metric tons was for the purpose of providing a reasonable surge capacity in the operating system, and to provide a limitation on the amount of material that could be stored at the MRS in direct response to the request from the MRS task force and the State of Tennessee to try to provide assurance that the MRS did not become the de facto final storage site for fuel.

The total amount of fuel that we now project that would be available, from all the reactors now operating over their lifetime, is in excess of 70,000 metric tons. Therefore if we limited it to 15,000 metric tons, that would mean that for sure we would have to have a repository. And that is the origin of the 15,000 ton limitation on the capacity.

Now, I said it takes about 300 or 400 acres to store 15,000 tons and have the other facilities. We asked for and looked at sites only with 1,100 acres for two purposes. One, to be sure we had a site that we could have a little buffer around, so that folks would not encroach on it.

And two——

Senator FORD. Eight hundred acres buffer, compared to 300 acres?

Mr. RUSCHE. The second point was that we might use some of that 800 acres for expansion of the storage area. I believe it is fair to say that on 1,100 acres one could store 70,000 metric tons in casks. We do not envision that. We did not propose that.

We believe it is wise though to have a piece of land that has flexibility for meeting conditions that you care to establish. We made our proposal to limit the capacity to 15,000 metric tons because we think that is the right way to go.

Senator FORD. Well, let me just say this. I do not know whether Oak Ridge is ready for it. But they had better grab hold of their britches because they are about to get 70,000 tons, in my opinion.

In my opinion, talk to my colleagues, there will be no permanent geological storage. With the expansion and just what you said there, as honest as you are, you have just laid it out. And that is basically what is going to happen. We will not need any other storage. You are going to do it in an MRS, and that is where it is going to be.

So I am for MRS. I think it ought to be right there where it is, and leave all the rest of us alone. I just think we ought to look at it, and you say you do not want it to be a de facto.

People there do not want it to be a de facto. You put a cap on it so it would indicate it would not. But in the same breath, you said that we want 800 more acres so we might expand. Expand for what?

Mr. RUSCHE. No, I did not say so we might expand. I said so there would be flexibility——

Senator FORD. To expand.

Mr. RUSCHE. To expand if you or someone else chose it.

Senator FORD. You are flexible to expand. That is just another way to say we could and we probably will. You and I will not be around here when that darn thing is completed.

Mr. RUSCHE. Oh, I plan to be. I plan to be.

Senator FORD. Well, I may not be here, but I hope both feet are on the ground and not under it.

Mr. RUSCHE. Excuse me, I sure hope I am not here.

Senator FORD. If your honesty——

Mr. RUSCHE. Gets me in trouble.

Senator FORD. Your honesty makes me feel better when I go to sleep because I know you are doing the right thing, at least in your own mind.

Mr. RUSCHE. Could I make one comment to clarify?

Senator FORD. You can make any kind of comment, after what I do to you. If we lose our good humor around here we might as well go home. And I am not ready to leave yet.

Mr. RUSCHE. Nor am I. I think that we had some discussion on this subject yesterday as to whether or not the country should turn away from permanent storage. And I am now speaking my personal opinion.

That is a dangerous thing for me to do, but I feel in that same sense of honesty that you have evidenced that I have to tell you, I think it would be wrong for the country to turn away from permanent disposal. Now if the schedule is wrong or there are difficulties that we have got to deal with that are not technical, then we have to deal with those.

But when you gave me the opportunity to sit here almost three years ago to the day, just short of one month, when you gave me the opportunity to come before you for confirmation, I told you that it was my view then that a system that had both MRS and a repository seemed to me to make more sense for the country. And that the law that you had prepared provided that opportunity and that we were going to look at it. We did, and I still believe that that judgment was right, after we have studied it extensively.

I think this country would be remiss if it turned away from geologic disposal as the objective of our waste program. The Swedes have elected to have geologic disposal, the Germans, the French, the Japanese, and I think that this country has heretofore in this one area been the world's leader. And I think it would be an unfortunate mistake to deny or to turn completely away from geologic disposal.

Now if we have not done the right job or we have done it in a way that is going to take more time, that is another matter. But I just cannot leave unsaid the view that geologic disposal, I believe, ought to be the objective for final disposal.

Senator FORD. I will tell you the two problems are political and budget. You can put them first or second, either way you want to. I think that would be the argument in the end will be the budget, which will be political.

Mr. RUSCHE. I will be glad to participate every way I can.

Senator FORD. I understand that. But I am just laying it out on the table. These are things that we are going to have to hit, and I think everybody ought to understand how I feel and where I think we are going. I am very strong for MRS.

Mr. RUSCHE. But recall if you will, that for the cost of MRS and for the cost of geologic disposal, the Congress has selected a method which does not address the general fund of the country at all. The payment is being made by rate payers.

You heard from the distinguished president, chairman of the National Association of Regulatory Commissioners this morning. And those folks are good stewards of rate payer money. They are very anxious about what we are doing. And they watch over us very carefully.

So I think that it is unfortunate in a sense that these funds do get mixed up with general fund considerations at budgetary time. But that is the way you provided it.

Senator FORD. Well, it is like everything else. Highway trust fund, you do not want to spend that, because of the deficit. You have got airport trust funds, you do not want to spend that because of the deficit. You have got another trust fund you want to spend. So we keep taxing the people and not spending it.

Mr. RUSCHE. Or spending it for something else.

Senator FORD. Soft money is money wherever it might be, whether it saves the utility by having MRS in the storage, or they do not have to charge the rate payers.

Mr. RUSCHE. Correct.

Senator FORD. Thank you, Mr. Chairman.

The CHAIRMAN. Let me just say that I agree with you that we will go and we ought to go, and the law provides for the dual track, both the MRS and the permanent repository. I just want to get that on the record that that is my view of the matter.

I do not want to cut anyone from full questions, but now that I have taken so long I might just remind the panel that we have another five witnesses after this. Senator Hecht?

Senator HECHT. As I mentioned this morning, I am not an attorney like you, and I will be much briefer than you are.

The CHAIRMAN. You are the most courteous and succinct Member of the panel, I might add.

Senator HECHT. In fact, I am going to limit my questions to two main points. You mentioned in your testimony that between five and 10 years, under the present law, you could put nuclear wastes into a deep-level repository. Is that not correct?

Mr. RUSCHE. No, sir. I did not say that, I do not believe.

Senator HECHT. It was brought out yesterday, 10 years. It could be taken and put in——

Mr. RUSCHE. In a deep repository? Our best estimate now is that we can have a repository in operation in the year 2003.

Senator HECHT. Yes, but after that the fuel could be put into the repository in the year 2003.

Mr. RUSCHE. Oh, I am sorry. The age of the fuel.

Senator HECHT. Yes, that is correct.

Mr. RUSCHE. The design basis for the repository is 10 years. But as I indicated to Senator Johnston, maybe you had stepped out Senator, that it is a relatively straightforward matter to in effect place the fuel in the repository commensurate with its age.

With the system that we now envision, the average age of fuel entering the repository in 2003 will be over 20 years, between 25 and 30, is my best estimate, just because we have the fuel sitting in the basins now from a long time.

Senator HECHT. All right. But let us project ourselves. The year 2005, a nuclear power plant has fuel, it could then be put in the repository 5 to 10 years from that time under the present law. Is that correct?

Mr. RUSCHE. The repository is being designed so that that could be done.

Senator HECHT. All right. Now my question. France does not do that. They feel they have to age it up to 40 years. Why are you saying that the spent fuel could be placed in the repository after only 5 to 10 years of aging?

Mr. RUSCHE. Again, earlier on I noted that under the Energy Reorganization Act of 1974 we are obligated to be in a position to receive fuel that is only 5 years old. The design basis is 10 years and the expectation is for fuel older than that.

I think the question that you will get to is, it is kind of a nonquestion, in that the repository can be designed to accept fuel of 5 years, of 10 years, of 20 years, of 30 years. And when you design the repository you do not in effect build the whole repository to meet one of those specifications. You can shape the repository as it is being built to accommodate fuel of whatever age you want to put in it.

Senator HECHT. I fully understand you, but why would you want to put fuel in before 40 years?

Mr. RUSCHE. If we did not have an MRS and we had a reactor whose basin was full, and the reactor developed some sort of difficulty and it was necessary to unload the reactor or to move fuel from that basin, we would need to have the capacity to take that fuel and put it in a repository.

Or if we have an MRS preferably we would be able to place it in an MRS, at whatever age it was.

Senator HECHT. Do you feel that the French are correct, that it is safer to store it at an MRS for say 40 years before you put it into a deep-level repository?

Mr. RUSCHE. Yes, but marginally.

Senator HECHT. What is that?

Mr. RUSCHE. Yes, but marginally. If you look at the——

Senator HECHT. You sound like a politician. Yes, but marginally.

Mr. RUSCHE. Well, let me tell you what marginally means, Senator.

Senator FORD. You are learning.

Mr. RUSCHE. If you took fuel that was 10 years old, our design basis and looked at its radioactivity or heat generation, which are roughly comparable, fuel that was 50 years old would be about half that. Fuel that was 100 years old would be about a fourth of that in heat generation, or in radioactivity.

That is what I mean by marginal. It is not trivial in the sense that it certainly would make a difference. But it is not a very large factor in terms of the effect on repository design, so to speak. The repository can accommodate whatever you want to put in it.

Senator HECHT. Yes, but it is very expensive and although it is trust fund money it is still expensive, and the French made such a point of how much easier it is to handle and how much more compact you can make it after 40 to 50 years.

Mr. RUSCHE. It does indeed get easier. And the question you have to balance is, who pays for storing it? If you store it for 40 years, you either have to store it at the reactor site for 40 years, or you have to store it at an MRS for 40 years, or you have to find somebody who will take it home for 40 years.

I should not be so flip, but what I mean is that you get to a place where saying it is lower heat generation or that it is easier is a statement that has to be stated in some specific terms to make a judgment on the issue.

Senator EVANS. Let me ask you, because it is an interesting point.

Could you, either now or for the record, tell us what the difference would be if you, just assume for the moment that you had an entire deep repository of 70,000 tons of material and assume that all of it was designed and built for fuel that was 10 years old, and compare that with a repository with 70,000 tons of spent fuel, all of which was 40 years old as an alternative.

Mr. RUSCHE. I will be glad to give you an approximation. My guess is that it would reduce the underground area required by something like 30 percent or 40 percent.

Senator EVANS. What about the cost of the underground storage?

Mr. RUSCHE. The underground area, I do not have those numbers in my head. But my recollection is the underground area may be 30 percent of the total life cycle cost, 20 or 30 percent. So you might reduce the total life cycle cost by 10 or 15 percent.

Senator EVANS. Of a total of what? What is the total expected cost of the life cycle?

Mr. RUSCHE. Again I am happy to drag numbers out of my head——

Senator EVANS. What is the life cycle cost of a 70,000 ton single repository?

Mr. RUSCHE. It is probably about $13 billion or $14 billion.

Senator EVANS. So something like 10 percent is $1.5 billion.

Mr. RUSCHE. So you might save $1.5 billion.

Senator EVANS. That is not cheap.

Mr. RUSCHE. It is not. And I am not suggesting——

Senator EVANS. That would pay for an MRS, would it not?

Mr. RUSCHE. It could. But, excuse me, Senator. You have got to find a way to store it somewhere. You have to now make the MRS storage capacity larger, or at-reactor storage larger.

Senator EVANS. I understand.

Mr. RUSCHE. That is why the idea of an integrated system is such an important concept. If you put your finger in the balloon over here, it is going to bulge out somewhere else unless you look at all of these factors simultaneously.

Senator HECHT. Credibility has been one of the problems on this, and safety is a No. 1 problem, and I just am pursuing this because I think we should leave no stone unturned as far as safety is involved. That is the reason that I keep pursuing this 40 to 50 year cooling off cycle, because it was pounded into me by the French and the Swedes.

Let us go to the next point I have which is also on safety. Reprocessing, you said the reason is an economic question today.

Mr. RUSCHE. Yes, sir.

Senator HECHT. In your opinion, is it safer to recycle before you put it into the ultimate deep-level repository? Forget money.

Mr. RUSCHE. On the safety question, Senator, if you look at a single pass and you consider a waste package that had no plutonium or neptunium in it, against a package that had plutonium or neptunium, then the package without the long-lived nuclides would be slightly safer.

But if you recycle it, it is just like the storage question. You have got to do something with that plutonium and neptunium. You either have to store it somewhere, not in the repository, or you have got to recycle it through a reactor. And you make some more or you make some fission products.

So in the end if you could consume the fission, if you could consume the plutonium or the neptunium without making more fission products, then it clearly would be safer. But we do not know how to do that. So if you have got fuel that has plutonium and neptunium in it, and you take it out, then you have got to do something with it, even if you do not put it in the repository. So the answer is not a straightforward easy answer.

Aside from that fact, reprocessing does not measurably increase the safety. The question then becomes whether the vitrified material, glass, is more leech-resistant than say the oxide form in which the fuel now is manufactured. And there is not a lot of difference between those.

Some data suggests that one is better than the other, and other data suggests the other way around. But the repository we are designing, as the Act requires, we would be equipped to accept either one of them and meet all of the safety standards.

Senator HECHT. You mentioned plutonium. The French say they get 99 percent of the plutonium out by recycling and the small particles that are left are down to one ten-millionth.

Mr. RUSCHE. That is probably true. And when they get it out, what do they with it?

Senator HECHT. They use it.

Mr. RUSCHE. For what?

Senator HECHT. Military.

Mr. RUSCHE. Well, that means they have it stored somewhere.

Senator HECHT. Well, it is a little different than a bomb.

The Chairman. They use it in mixed oxide fuels as well.

Mr. RUSCHE. When they use it in mixed oxide fuel they make more plutonium and more fission products. Every time you fission in a reactor, you produce additional plutonium and neptunium and waste.

Senator **Hecht**. As the Senator said, it is in different areas. It is not in deep-level repositories.

Mr. **Rusche**. That is correct. If you look at the repository by itself then the statement that I made I think is valid for a short time. But in the end you have to look at the aggregate of the whole system for its lifetime.

And if you take the plutonium and eventually you are either going to have to dispose of it, and if you consume it you make some more. And you have to go through that balance to determine whether it is a net positive activity.

Senator **Hecht**. You brought up the question of economics, strictly right at the moment. You know, we subsidize agricultural products. I am not on the Agriculture Committee. I do not know whether we subsidize soy beans or cabbage or what have you, but if the safety factor is there, would we not be better off to take a look at that and forget the economics?

Mr. **Rusche**. I think the safety factor you are talking about with respect to waste disposal is very small, and does not warrant the kind of national decision which would have to be a forcing decision on the part of the government to say that reprocessing would be required.

I think reprocessing is a matter that ought to be left to the private sector to decide. It is not a matter of such significance that we can make a prior determination that all material ought to be reprocessed for safety purposes. I do not believe that is the case.

Senator **Hecht**. One of the gentlemen, I do not remember his name, I spoke to yesterday, and I asked him about how we handle military waste and civilian waste. I said, would it be better to handle both the same way? And he said, yes. You feel that way.

Mr. **Rusche**. If we had something to do with it, yes. But the reason we handle military waste the way we are handling it is because it has been determined that it is appropriate and cost-effective. It is not for safety reasons.

Senator **Hecht**. Well, military waste and civilian waste will both be put into the deep-level repository.

Mr. **Rusche**. Correct.

Senator **Hecht**. And one will be handled one way and one will be handled another way.

Mr. **Rusche**. One will be produced one way and one will be in a different form.

Senator **Hecht**. Is that correct?

Mr. **Rusche**. That is correct.

Senator **Hecht**. Would it not be easier to have the same?

Mr. **Rusche**. From the standpoint of the operation of the repository it does not make that much difference.

The **Chairman**. Thank you, Senator Hecht. Mr. Rusche, I have some more questions, I really want to ask you about this transportation, but we have got a distinguished panel here from Tennessee and elsewhere. And I had better get on to them. But thank you very much for your testimony.

Mr. **Rusche**. Thank you, sir.

The **Chairman**. Next we are pleased to have Roy Pruett, who is the mayor of Oak Ridge, TN, and Ken Yeager, who is the county executive from Roane County, TN.

Gentlemen, welcome to the committee and Mayor Pruett we are glad to hear first from you. Your written statements, of course, will be put into the record, and we would prefer that you summarize.

STATEMENT OF ROY F. PRUETT, MAYOR, CITY OF OAK RIDGE, TN

Mr. PRUETT. Thank you very much, Mr. Chairman, and Members of the Committee. My name is Roy Pruett, mayor of the city of Oak Ridge, TN, and an executive committee member on the Clinch River MRS task force.

It is my pleasure to be here today to testify before this distinguished Committee and present the findings of the Clinch River task force as they relate to subtitle C of the Nuclear Waste Policy Act of 1982, and to the Department of Energy proposal on the Monitored Retrievable Storage facility, the MRS.

As the committee is aware, I represent the city of Oak Ridge, which has been selected for the primary and the first alternative for the siting of an integrated MRS facility for the preparation and packaging of high-level nuclear waste and spent reactor fuel.

As the potential host community, we in Oak Ridge and Roane County are unique from the other governments who may be impacted by the siting of an MRS, for we are the situs committee who alone must live day to day with the facility in our own background, with all of its attendant concerns and risks, should the sited construction within Roane County portion of Oak Ridge.

As such, we have a particularly strong interest in dialog with Congress, and appreciate the opportunity afforded today to commence that process. Senator Ford, when I get back home I am going to withdraw 800 acres from that 1,100.

The Clinch River MRS task force was appointed in July, 1985 to study and recommend a community position as the proposed MRS facility, or for the proposed facility in Oak Ridge. After several months of study by the blue ribbon panel it turns out to be just that.

Of civic and governmental leaders, we concluded that an MRS could safely be built and operated in Oak Ridge. We further concluded, however, that the facility would not be generally perceived as being safe unless the recommendations of the task force were adopted to address concerns and help mitigate impact. Indeed the MRS would not be viewed as a net economic benefit to the situs community, the region, or the State of Tennessee without such appropriate conditions.

The task force identified five major areas of concern regarding the siting of an MRS facility, including the health and safety issues, which were and still remain our primary concern, the potential of becoming a de facto site for permanent storage, and I want to underline that, the adverse effects of the facility may have on the economic growth and diversification of the situs communities, region, and the State of Tennessee, and for assurances that all commitments will be fulfilled by the DOE and the Congress, and fifth the unfavorable image that might result from the perception of being a nuclear waste dump rather than that of a high quality community, which we are.

These five major areas were supported by 32 specific recommendations as identified by the Clinch River task force and have been included in the executive summary, and you have copies of that in your folder. Let me note that it was not our charge nor our undertaking to determine whether the MRS was a necessary component in the disposal system for high-level nuclear waste. Rather that was an issue that the Congress itself must decide.

Our charge was rather to view from a community perspective the proposal before us and to identify our concerns, anticipated impacts and recommended mitigative measures which would allow an MRS facility to be safely built and operated in the Roane County portion of Oak Ridge.

The Department of Energy proposal of March, 1987 for the construction of an MRS facility in the city of Oak Ridge has yet to be formally reviewed by the task force, because of the short time since its public release. Therefore I am unable to provide official position of the Oak Ridge community concerning the details of its provisions.

With your indulgence, we will forward a detailed review upon the completion in the very near future. However, there are some serious shortcomings in the proposal that I have identified and which need to be positively considered by the Congress. These are crucial elements as identified in the task force study.

The city must be an active participant in all deliberations with DOE concerning the facility. The Congress must amend into the act the authority for the DOE to negotiate with the situs governments through cooperation and consultation agreements so that the interest of the community that must host the facility will be best protected and represented.

The State government must continue to have an equal role in the process. But by its nature it must represent a much larger public with an entirely different set of priorities and concerns. We recognize that are not trying to dilute that important role.

On the other hand we are the people who will have accepted all the risks and we will have to live under the shadow of the facility with its unknown effects on our future health, safety, welfare, economic well-being and prosperity.

As such, genuine local control must be provided to the community in a manner that will guarantee our voice to be clearly heard. We feel that this can only be guaranteed through congressional amendment of the act, which expressly authorizes C&C agreements directly between DOE and the situs governments.

Furthermore, in order to assure that commitments established in the C&C agreements are met, the Clinch River task force has recommended that the authorizing legislation provide that the 60 day period for issuance of formal notice of disapproval begins 6 months after C&C negotiations commence. This recommendation was outlined in a task force response to the original review edition of DOE's MRS proposal, dated January 16th, 1986.

An equitably represented citizen environment safety and health review board must be given substantive power. Without diligent adherence to the rules, regulations and safety procedures, the MRS could adversely impact the surrounding population and local environment. As such a board comprised of equal number of members from the situs communities and the state should be created to represent the local community interests during all phases of the facility's life.

Additionally, procedures should be developed whereby the board could cause a suspension of operations if releases from the MRS are above jointly pre-established levels. The DOE proposal represents a significant step forward in public participation.

[The prepared statement of Mr. Pruett follows:]

Testimony of Roy F. Pruett, Mayor
City of Oak Ridge, Tennessee

before the

UNITED STATES SENATE

Committee on Energy and Natural Resources

on the Department of Energy proposal for the
Monitored Retrievable Storage Facility

The Honorable J. Bennett Johnston, Chairman

Wednesday, April 29, 1987

The Honorable Senator Johnston, Members of the Committee, and Ladies and Gentlemen:

My name is Roy F. Pruett, Mayor of the City of Oak Ridge, Tennessee, and Executive Committee Member of the Clinch River MRS Task Force. It is my pleasure to be here today to testify before this distinguished committee and present the findings of the Clinch River MRS Task Force as they relate to Subtitle C of the Nuclear Waste Policy Act of 1982 and to the Department of Energy proposal on the Monitored Retrievable Storage (MRS) facility.

As the committee is aware, I represent the City of Oak Ridge which has been selected as the primary and first alternative for the siting of an integrated MRS facility for the preparation and packaging of high-level nuclear waste and spent reactor fuel. As a potential host community, we in Oak Ridge/Roane County are unique from the other governments who may be impacted by the siting of an MRS for we are the situs community who alone must live day to day with the facility in our own backyard, with all its attendant concerns and risks, should it be sited and constructed within the Roane County portion of Oak Ridge. As such, we have a particularly strong interest in continuing dialogue with Congress and appreciate the opportunity afforded today to commence that process.

The Clinch River MRS Task Force was appointed in July 1985 to study and recommend a community position to the proposed MRS facility in Oak Ridge. After several months of study by the "Blue Ribbon Panel" of civic and governmental leaders, we concluded that an MRS could be safely built and operated in Oak Ridge. We further concluded, however, that the facility would not be generally perceived as being safe unless the recommendations of the Task Force were adopted to address concerns and help mitigate impacts. Indeed, the MRS would not be viewed as a net economic benefit to the situs communities, the region, or the State of Tennessee without such appropriate conditions.

The Task Force identified five major areas of concern regarding the siting of an MRS facility, including:

1. Health and safety issues, which were and still remain our primary concerns;
2. The potential of becoming a de facto site for permanent storage;
3. The adverse effect the facility may have on economic growth and diversification of the situs communities, region, and the State of Tennessee;
4. Assurances that all commitments will be fulfilled by DOE and the Congress;
5. The unfavorable image that might result from the perception of being a "nuclear waste dump" rather than that of a high quality community, which we are.

These five major areas were supported by 32 specific recommendations, as identified by the Clinch River Task Force and included in the executive summary. Copies have been provided for you.

Let me note that it was not our charge, nor our undertaking, to determine whether an MRS was a necessary component in the disposal system for high-level nuclear wastes. Our charge was rather to view, from a community perspective, the proposal before us and to identify our concerns, anticipated impacts, and recommended mitigative measures which would allow an MRS facility to be safely built and operated in the Roane County portion of Oak Ridge.

The Department of Energy proposal of March 1987 for the construction of an MRS facility in the City of Oak Ridge has yet to be formally reviewed by the Task Force because of the short time since its public release, therefore, I am unable to provide the official position of the Oak Ridge community concerning the details of its provisions. With your indulgence, we will forward a detailed review upon its completion in the near future. However, there are some serious shortcomings in the proposal that I have identified and which need to be positively considered by the Congress . These are crucial elements, as identified in the Task Force Study:

The City must be an active participant in all deliberations with DOE concerning the facility. The Congress must amend into the Act the authority for the DOE to negotiate with the situs governments through Cooperation and Consultation Agreements so that the interests of the community that must host the facility will be best protected and represented. The State government must continue to have an equal role in the process, but by nature it must represent a much larger public with an entirely different set of priorities and concerns. We recognize that and are not trying to dilute that important role. On the other hand, we are the people who will have accepted all the risks and who will have to live under the shadow of the facility with its unknown effects on our future health, safety, welfare, economic well-being and prosperity. As such, genuine local control must be provided to the community in a manner that will guarantee our voice to be clearly heard. We feel this can only be guaranteed through congressional amendment of the Act which expressly authorizes C & C agreements directly between DOE and the situs governments.

Furthermore, in order to assure that commitments established in C & C agreements are met, the Clinch River MRS Task Force has recommended that the authorizing legislation provide that the 60-day period for issuance of a formal notice of disapproval begins six months after C & C negotiations commence. This recommendation was outlined in a Task Force response to the original review edition of DOE's MRS proposal dated January 16, 1986 (copies are provided).

An equitably represented citizen Environment, Safety, and Health Review Board must be given substantive powers. Without diligent adherence to rules, regulations, and safety procedures, the MRS could adversely impact the surrounding population and local environment. As such, a board comprised of an equal number of members from the situs communities and the state should be created to represent the local community interests during all phases of the facility's life. Additionally, procedures should be developed whereby the Board could cause a suspension of operations if releases from the MRS are above jointly preestablished levels. The DOE proposal represents a significant step forward in public participation but fails to fully recognize this significant environmental issue, and it falls short of the comfort levels necessary for our community to be assured that the facility is indeed being operated safely and in a manner befitting our local citizens.

The principle impact of the MRS will be on local jurisdictions; consequently, the local jurisdictions involved must have a substantially significant role in the oversight of MRS planning, construction and operation.

The MRS must not become a de facto permanent repository. The MRS facility could delay the construction and operation of a permanent geologic repository and become a de facto site for high-level nuclear waste and spent reactor fuel. Although good efforts have been proposed by DOE to prevent this from occurring, a vulnerability still exists which needs to be addressed. In addition to the preclusion of waste acceptance by the MRS until a construction authorization for the repository is received, and in addition to the limitation of the MRS to 15,000 metric tons of spent fuel, we feel it is imperative that provisions for a significant "overdue-removal" penalty must also be provided. This would be viewed as a further commitment of good faith on the part of Congress toward maintaining the stated purpose of the MRS as a temporary storage and repackaging facility. This has not been included in the DOE proposal now before you.

The preferred Oak Ridge site is not the optimal site for facility siting. Should Congress indeed decide that an MRS is a necessary component in the nuclear waste disposal process and, further, should the City of Oak Ridge be selected as the site for such a facility, it would be our preference that the first alternative site within the DOE reservation be utilized to host this facility instead of the Clinch River site owned by the Tennessee Valley Authority. The Clinch River site is the only large land mass within our community not controlled by DOE that is suitable for large scale private economic development. We have been active in marketing that site to major industrial corporations, and it would be a significant loss in our efforts to diversify the local economy should the only large site in our inventory of land suitable for a major expansion or relocation be lost through the MRS siting.

The DOE reservation site which is already owned and under control of the government is the better site if the Congress is interested in diversifying the economy of the local community and, as such, we would strongly encourage selection of the reservation site over the Clinch River site, if the MRS is to be sited here at all.

In addition to those items specifically cited above concerning the MRS proposal, there are many other items of importance to our local community which need to receive full and proper consideration by Congress. The Clinch River MRS Task Force recommendations remain our definitive community statements and, as such, deserve your utmost attention and consideration.

It closing, let me outline some crucial elements to consider regarding any change in the policies and programs guiding the selection of sites for the storage and disposal of high-level nuclear waste and spent reactor fuel:

1. Fair and adequate compensation must be provided to the affected jurisdictions. The state and situs governments must be adequately compensated for the tremendous service that they provide to the nation in the storage, packaging, and disposal of high-level nuclear waste. Compensation should reflect the value of that service to the nation and should recognize the socioeconomic impacts, health/safety risks, and public service provided to the citizens of the United States of America as a direct result of its siting and operation. Compensation must be at a rate equal the taxes that would be paid if the facility were privately owned and fully taxed.

2. Situs governments must be compensated separately. Situs governments have a unique role and responsibility which must be recognized and which deserve special financial consideration and compensation in addition to that provided to the state or other affected local governments. The special burden placed on situs communities and the truly heroic service that they provide to the nation is deserving of compensation in sufficient amounts and kinds which must be guaranteed by Congress through dedicated revenue sources to the situs community's treasury.

Finally,

3. The State's role to veto the siting of a nuclear waste facility must be retained. The state has a major responsibility to its citizens for their collective health, safety, welfare, and prosperity--all of which may be jeopardized by the siting of a nuclear waste handling facility. That gubernatorial prerogative is one that must be protected and respected.

In summary, the Department of Energy proposal for the construction of a Monitored Retrievable Storage facility in the Roane County portion of Oak Ridge has addressed many of the concerns of the Clinch River MRS Task Force, for which they should be commended. The Department has failed, however, to include certain other important items including local oversight and control of the facility and direct C & C agreements with the situs community including compensation payments which are of utmost importance to us.

Congress has an opportunity to amend the DOE proposal and accept the stringent, but reasonable, conditions recommended by the Task Force which could make the MRS facility acceptable to the communities of Roane County and Oak Ridge. I encourage you to adopt the Task Force recommendations in total and to seriously consider the other concerns enunciated by the situs governments as presented before you today.

Thank you for your kind consideration and attention. We will be prepared to provide any additional assistance as may be required by the Committee.

Roy F. Pruett, Mayor
City of Oak Ridge, Tennessee
Post Office Box 1
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CLINCH RIVER MRS TASK FORCE
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Clinch River MRS Task Force

POSITION ON THE PROPOSED MONITORED RETRIEVABLE STORAGE FACILITY

ABSTRACT: The Clinch River MRS Task Force was appointed in July 1985 by the Roane County Executive and the Oak Ridge City Council to evaluate the Monitored Retrievable Storage (MRS) facility proposed by the Department of Energy to be constructed in the Roane County portion of Oak Ridge. After several months of study, numerous public meetings, site visits to relevant facilities, and careful evaluation of the integrated MRS concept, it is the considered opinion of the Task Force that the facility could be safely built and operated in Roane County/Oak Ridge. However, an MRS facility constructed in the Roane County portion of Oak Ridge would not be generally perceived as being safe by the citizens of Roane County and Oak Ridge unless the recommendations of the Task Force are prescribed to be implemented by the MRS authorizing legislation. Moreover, unless the listed concerns are addressed and impacts mitigated, the MRS would not be seen as providing net economic benefit to the local communities, region, and state. Provided DOE is required by Congress to comply with stringent, but reasonable, conditions recommended by the Task Force, the group finds that the MRS facility could be made acceptable to the communities of Roane County and Oak Ridge. The Roane County Commission, Oak Ridge City Council, State of Tennessee, United States Department of Energy, and Congress of the United States are requested to adopt the recommendations of the Clinch River MRS Task Force.

Monitored Retrievable Storage

The Nuclear Waste Policy Act of 1982 requires the Department of Energy (DOE) to provide for the development of deep, geologic repositories for the disposal of spent nuclear fuel and other high-level radioactive wastes and to submit for Congress' consideration a proposal on the need for one or more Monitored Retrievable Storage (MRS) facilities. Although the MRS was initially considered as a backup for a repository, DOE determined that the facility would perform a more effective role as a receiving, packaging, and lag storage center handling fuel assemblies en route to the repository. The MRS proposed by DOE and evaluated by the Task Force is often referred to as an Integral Monitored Retrievable Storage or I-MRS facility.

The Clinch River MRS Task Force

Following the Department of Energy's announcement in April 1985 that three Tennessee sites were to be considered for the Monitored Retrievable Storage facility, Governor Lamar Alexander initiated a review of the proposal to be coordinated by his Safe Growth Team. Roane County and the City of Oak Ridge, the local governments sharing jurisdiction over DOE's primary and secondary sites, were invited to participate in the state's review of the MRS proposal. A similar invitation was provided to local governments in the Hartsville area, location of the third alternative MRS site. The Clinch River MRS Task Force was devised as a means of accomplishing a local evaluation of the Oak Ridge sites. To defray expenses incurred by the Task Force, a $100,000 grant was awarded by the Tennessee Department of Health and Environment from $1.4 million provided by DOE to fund the state's review of the MRS proposal.

Many issues related to the proposed MRS are being considered by the Governor's Safe Growth Team. The primary objective of the Clinch River MRS Task Force has been to determine whether the proposed Monitored Retrievable Storage facility should be accepted by the local governments, and if so, under what conditions. The Task Force has not addressed the question of need for the MRS or the rationale employed by DOE in recommending that it be constructed in Tennessee. It is the belief of the Task Force that these are issues to be resolved by Congress, not by the local communities.

The 31-member Task Force is composed of an equal number of appointees from the County and City, with staff support provided by the City of Oak Ridge. The Clinch River MRS Task Force is organized into an Executive Committee cochaired by the Roane County Executive and Mayor of Oak Ridge and three Study Groups focusing on environmental (including health and safety), socioeconomic, and transportation issues. Each eight-person Study Group is composed of an elected County Commissioner and City Councilman, three citizens appointed by the County, and three citizens appointed by the City. Each Study Group is supported by a City staff person. Additional support is provided as needed by the two local governments, interns, and consultants.

Task Force members have contributed considerable time in evaluating the MRS proposal. The Task Force as a whole has conducted monthly work sessions and business meetings since its establishment. Study Groups have typically held weekly work sessions. In addition, the Task Force and its Study Groups have sponsored several special events designed to involve the entire community in the evaluation process. All meetings have been open to the public. To supplement the series of public meetings, Task Force members have visited relevant federal and private facilities. Sites visited have included a fuel handling facility at Morris, Illinois, operated by General Electric; low-level radioactive waste facilities in Barnwell, South Carolina, operated by Chem-Nuclear; fuel handling and storage facilities at DOE's Idaho National Engineering

Laboratory and DOE's Nevada Test Site; and cask testing facilities operated for DOE by Sandia National Laboratory at Albuquerque, New Mexico. Cask testing and reactor fuel handling sites at the Oak Ridge National Laboratory were also visited, as was the Radiation Emergency Assistance Center/Training Site operated by Oak Ridge Associated Universities.

The Department of Energy is scheduled to present its recommendations on the MRS facility to Congress in mid-January of 1986. At the time of its inception, the Clinch River MRS Task Force determined that its initial position on the proposal to place the MRS facility in Oak Ridge should be completed in time to be of use to DOE in the preparation of those recommendations. Consequently, it has been necessary for the Task Force to complete its evaluation within a very limited time frame. The Department of Energy has not yet issued its environmental assessment of the proposed facility, and a full environmental impact statement (EIS) is not required until the MRS is authorized by Congress. The Clinch River MRS Task Force and the local government it represents, anticipating full participation in the review of these and other important forthcoming documents, reserve the right to modify positions taken based on information yet to be presented.

The Nuclear Waste Policy Act establishes a unique process of consultation between DOE and state and local governments. This is a welcome step in the improvement of intergovernmental relations. In its prompt response to written and verbal questions and requests for available information, the Department of Energy has been most cooperative in assisting the Clinch River MRS Task Force to complete its initial review. DOE and contractor personnel have been available at most, if not all, Task Force meetings to answer questions.

Summary of Findings

Based on its review of the proposed MRS facility and its expectation that Congress and the state will adopt the conditions recommended below, the Clinch River MRS Task Force concludes the following:

1. Spent nuclear fuel and other high-level radioactive wastes can be safely transported.

   - Spent nuclear fuel is highly radioactive, and exposure to even low levels of radiation over sufficiently long periods of time can cause harmful health effects. However, spent nuclear fuel is not explosive. Nor is there risk of a self-sustaining nuclear reaction within a shipping cask.

   - Spent fuel shipping casks are heavily shielded and constructed so as to protect the public from any significant radiation levels.

-- The NRC-licensed casks designed for shipment of spent nuclear fuel provide for containment of their contents in the event of accidents. Extensive testing has proven that such casks can provide for safe shipment of fuel assemblies to and from the proposed MRS. Any future casks will be subject to the stringent regulations required of current casks.

– The federal government and nuclear industry have safely transported nuclear waste materials for nearly 30 years, including hundreds of spent nuclear fuel shipments through Tennessee. There has never been an accidental release of radioactive material in the transport of spent nuclear fuel.

– The state would determine by which Tennessee routes spent fuel will be shipped to and from the proposed MRS facility. The rail line upgrades and roadway upgrades and improvements for State Routes 58 and 95 recommended by the Task Force would support safe travel from the main rail line and interstate to the proposed MRS sites.

– Shipments of spent nuclear fuel are already strictly regulated for safety and security purposes and provide an adequate margin of safety. If the escort and inspection procedures recommended by the Task Force are adopted, the margin of transportation safety would be enhanced.

– The emergency response planning procedures and DOE-provided first responder training program recommended by the Clinch River MRS Task Force would prepare the state and local governments to deal with any accident involving the transport of spent nuclear fuel.

2. Based on the best information currently available to the Task Force, either the preferred Clinch River site or the secondary DOE Reservation site could accommodate the proposed MRS facility from an environmental viewpoint.

– Ecosystem damage does not appear so significant as to be an overriding factor in determining location of the proposed MRS facility at either Roane County/Oak Ridge site. Mitigation of ecological and scenic impacts would be possible following the recommendations of the Task Force.

– Site design of the proposed MRS seems to assure that its component facilities would be properly placed relative to natural features. This region is not prone to significant earthquakes, the proposed sites are located will above flood levels, and the underlying rock formations will support the MRS receiving and handling facility.

3. The proposed MRS facility can be safely constructed and operated.

   - The MRS facility would be fully licensed by the Nuclear Regulatory Commission (NRC), which would regulate its construction and operation.

   - In addition to NRC regulations, the construction of the proposed MRS would be subject to numerous federal, state, and local codes, as well as industry standards.

   - The construction methods and operating technologies of the proposed MRS are already largely proven.

   - All fuel assemblies would be remotely handled in "hot cells" to protect workers and the surrounding population. The facility would be constantly monitored to detect radiation levels, and sufficient redundancy in environmental control and monitoring systems would assure that performance standards are met.

   - Compared to a conventional factory or processing plant, the MRS would be a relatively "clean" facility. NRC regulations control any liquid, solid, or gaseous escapes, and limit such releases to the outside environment.

   - Radiation monitors located inside and outside the MRS facility would ensure detection and warning of accident conditions.

   - Typical background radiation levels from natural and medical sources are between 100 and 200 millirem per year in the East Tennessee area. Operational radiation exposure to a person living near the proposed MRS facility is stated to be less than an additional millirem per year.

   - Adoption of Task Force recommendations regarding establishment of an MRS Environment, Safety, and Health Review Board and the implementation of a Community Environmental Monitoring Program would ensure local oversight of regulatory activities. Such oversite would provide the population surrounding the proposed MRS increased understanding and thus increased confidence in the environmental release data.

4. The proposed MRS facility could benefit the economies of the local communities, the region, and the State of Tennessee.

   - The proposed MRS facility would employ approximately 750 contractor and DOE personnel. Annual operating costs, including payroll expenditures, would be approximately $50 million.

   - Construction of the MRS facility itself would cost approximately $1 billion. Costs for on-site storage casks would eventually amount to approximately $300 million. Research and development activities associated with transportation issues could cost more than $200 million. Expenditures associated with transportation cask production and transport could total $3 billion. With adoption of Task Force recommendations to encourage the procurement of goods and services from Tennessee vendors, a portion of this business would stay in the state.

- Potential support and satellite activities associated with the MRS would include training, transportation, metals technology, waste packaging, laser cutting, and robotics.
- As recommended by the Task Force, annual impact assistance payments equivalent to tax revenue on a $1 billion industrial facility would be made to state and local governments from authorization of the MRS until its operation, and again from cessation of operations until its complete decommissioning.
- Assuming adoption of Task Force recommendations, during operations the MRS would pay grants equivalent to all state and local taxes, annually generating several million dollars in much needed public revenue.

Summary of Concerns, Anticipated Impacts, and Recommended Mitigations

Even assuming the proposed MRS facility would contribute to resolution of the nation's spent fuel disposal problems, an MRS constructed in Oak Ridge would neither be acceptable nor provide net economic benefit to the local communities, region, and state unless certain critical concerns are addressed and impacts mitigated. The most important issues identified by the Clinch River MRS Task Force are enumerated below, along with recommended mitigating actions. Because the process of MRS authorization and construction would be a long one, it is important that mitigative measures be agreed to early and formalized in binding agreements. However, it should be noted that the Task Force is at this point most interested in making clear its objectives, not necessarily in dictating the specific means for achieving them.

1. Without diligent adherence to rules, regulations, and safety procedures, the MRS could adversely impact the surrounding population and local environment. Monitored Retrievable Storage health and safety issues are considered by the Clinch River MRS Task Force to be of primary importance. It is critical that the following recommendations be adopted:

   1.1. A citizen MRS Environment, Safety, and Health Review Board should be established to represent the communities' interests during construction, operation, and decommissioning of the proposed MRS facility. The Board would be characterized as follows:

1.1.1. An equal number of Board members would be appointed by Roane County, the City of Oak Ridge, and the state.

1.1.2. The Board would operate under formal arrangements with responsible federal agencies. It would not supplant regulatory agencies responsible for activities at the proposed MRS and, to the greatest extent possible, would make use of data collected by those agencies. However, the Board should have the authority to conduct its own inspections and collect additional data as needed.

1.1.3. The Board should participate in the development of environment, health, and safety performance standards and criteria for the MRS facility and have access to all information on the condition of shipments arriving at the MRS, effluents released to the outside environment, radiation exposure to workers and the surrounding population, accidents, and incidents as classified by the NRC.

1.1.4. Procedures should be developed whereby the Board could cause a suspension of operations if releases at the MRS are above action levels jointly preestablished with DOE and regulatory agencies.

1.2. Management of plant operations should be designed to limit the potential for harm to workers and the surrounding population. Such procedures should incorporate the following:

1.2.1. Local environmental and demographic parameters should be used to evaluate the consequences of air or liquid releases. Performance standards and graded action levels should be developed for evaluating and responding to releases.

1.2.2. Performance standards should require a vigorous "As Low As Reasonably Achievable" (ALARA) program to control radiation exposures, and sufficient redundancy of control and monitoring systems should be utilized to assure that standards are met.

1.2.3. All information on radiation releases and accidents should be made available to the proposed MRS Environment, Safety, and Health Review Board as well as to the general public.

1.2.4. A Community Environmental Monitoring Program similar to the one operated by EPA at DOE's Nevada Test Site should be established well in advance of MRS operations.

1.3. Research, development, and rigorous testing should continue on prototypes of spent fuel transportation and storage casks so that those models put into service in conjunction with the proposed MRS facility are proven to effectively withstand accident conditions and contain radioactive materials.

1.4. Transportation safety should be enhanced by means of "gold star" inspections performed at the originating point of each spent fuel shipment and again at the MRS facility. Shipments out of the MRS to the permanent repositories should be subject to identical inspections. These inspections, conducted by personnel independent of DOE, should guarantee compliance with rigid standards relating to radiological, vehicle, and personnel safety. Those conducting such inspections should have authority to detain noncomplying outgoing shipments and to levy stiff penalties for noncompliance with applicable standards.

1.5. For purposes of assuring continuing communications and rapid response to emergencies, each spent fuel shipment to and from the MRS should be accompanied by a single vehicle escort.

1.6. As the NRC licensee for the MRS facility, DOE should assume the lead role in developing emergency response procedures to be followed by local and state public safety personnel in the event of an accident involving spent nuclear fuel. First responders from local and state agencies should be trained and equipped by the federal government with associated costs, including partial operations funding, borne by the Nuclear Waste Fund.

1.7. The local governments in the MRS site area (e.g., those in Anderson, Knox, Loudon, and Roane Counties) would experience the greatest transportation impacts from operation of the facility. Formal opportunities should be granted for local governments in this area to address with DOE such transportation issues as routes, travel speeds, and operating procedures. The Task Force at this time specifically recommends the following:

1.7.1. Both state roads 95 and 58 should be designated as preferred routes for transport of spent nuclear fuel from the interstates to the proposed MRS. Use of other existing routes should be prohibited except in the case of emergencies.

1.7.2. Costs for necessary improvements to state and local routes used for transport of spent fuel to and from the MRS should be borne by the federal government outside the normal allocation of highway funds to the State of Tennessee.

1.7.3. Spent fuel should be transported on railroad tracks in Tennessee that meet Class IV structural standards. The rail links between main lines and the MRS facility should meet these standards.

1.8. To mitigate the adverse construction impacts on private property surrounding the proposed MRS facility, the Task Force recommends establishment of a heavily landscaped buffer around the selected site and adherence to state and local noise, blasting, erosion, and other development codes.

1.9. The secondary radioactive waste generated at the proposed MRS (i.e., assembly fittings, contaminated gloves and protective clothing, etc.) should be disposed of outside Tennessee.

1.10. To address concerns regarding long-term site conditions, a plan should be established before operations at the MRS begin outlining how the facility would eventually be fully decommissioned and decontaminated so that the site can be made available for unrestricted use at the earliest possible date.

2. The proposed MRS facility could delay construction of the geologic repository and become a de facto site for permanent spent fuel storage. Despite clearly stated national policy to the contrary, there are legitimate concerns that once in operation, the MRS would relieve pressure on DOE and the Congress to follow through on plans to construct a permanent repository. The Task Force recommends that MRS-authorizing legislation specify the following:

2.1. No more than 300 metric tons of spent fuel should be received by the MRS facility before a construction license is granted for the permanent repository.

2.2. No more than 10,000 metric tons of spent fuel should be received before the out-shipments of consolidated fuel rods begin to the permanent repository.

2.3. Any proposed extension of the MRS storage capacity beyond the 15,000 metric tons currently envisioned should be subject to the same review and notice of disapproval procedures followed to initially authorize the MRS.

2.4. Any spent fuel stored at the MRS longer than 15 years should be subject to a significant "overdue-removal penalty" levied by the state.

3. The MRS facility could hinder the communities' efforts to diversify and expand their commercial/industrial base. There is concern that the MRS, if handled as just another federal facility, would significantly impede the local communities' efforts to achieve a strong and more diversified economic base. In addressing this concern, the Clinch River MRS Task Force recommends the following:

3.1. With regard to permanent repositories, Section 116(c) of the Nuclear Waste Policy Act directs that host jurisdictions receive grants equal to taxes that would be paid were the facilities privately owned. Authorizing legislation should ensure these or equivalent provisions apply to the MRS as well. Such authorization should additionally provide for:

- Coverage for all local and state taxes, including real and personal property taxes; and

- Specification of how tax equivalency will be administered, including valuation formulas, and for an arbitration board or alternative means for settling disputes.

3.2. Annual impact assistance payments commensurate to grants equal to taxes paid on a $1 billion facility should be provided to the state, Roane County, and the City of Oak Ridge beginning with the date of Congressional authorization of the MRS and continuing until grants equivalent to taxes are made on the constructed facility. Such impact assistance payments should again be made from cessation of operations at the facility until it is completely decommissioned.

3.3. The management of MRS design, construction, and operation, as well as management of transportation for the entire civilian radioactive waste program, should be relocated to DOE's Oak Ridge Operations office.

3.4. Proximity to Oak Ridge should be established as a significantly weighted selection criterion for MRS procurement so that, to the fullest extent possible, all related research, development, goods, and services are acquired from within the communities, region, or state.

3.5. To the greatest extent possible, all MRS related activities should be conducted in the private sector and on privately owned facilities.

3.6. A significantly weighted criterion for selection of major contractors to construct, operate, and provide services to the proposed MRS facility should be the commitment of those firms to the diversification of the communities' economic base. All contractors selected should be expected to bring non-DOE business into the communities.

3.7. Programs necessary for MRS and transportation system employee training should be provided through local educational institutions.

3.8. To assist in the communities' continued industrial development activities, DOE should make available for purchase at full market value an industrial site in the Roane County portion of Oak Ridge which is equivalent to the Clinch River site.

4. Public trust in DOE has seriously eroded. Environmental problems, long-standing debates on issues of taxation, and DOE's historically poor relations with the communities and state leave many skeptical that DOE's assurances regarding the MRS will be fulfilled.

4.1. Section 117(c) of the Nuclear Waste Policy Act provides for "consultation and cooperation" (C & C) agreements between DOE and the state. The MRS-authorizing legislation should provide for C & C agreements directly betweeen DOE and units of local government as well as between DOE and the state.

4.2. In its authorization of the MRS, Congress should specify DOE's compliance with Task Force recommendations contained herein, whether through C & C agreements or other means. The C & C agreements must be completed before the state's right to issue a notice of disapproval expires. In authorizing the MRS, Congress should provide that the right to issue a notice of disapproval expires at the end of the 60-day period specified by the Nuclear Waste Policy Act or six months after commencement of C & C negotiations with state and local governments, whichever is later.

4.3. The local governments should be granted preferred status in continuing interactions with the state, DOE, and NRC regarding the MRS. The communities' future recommendations should be given full consideration and, when appropriate, incorporated into C & C agreements.

4.4. A schedule for bringing all DOE Oak Rige Operations facilities into compliance with state and federal environmental regulations should be established prior to Congressional authorization of the MRS, and clean-up programs should be implemented to the satisfaction of regulatory agencies prior to commencement of MRS operations.

4.5. Establishment of the aforementioned MRS Environment, Safety, and Health Review Board and Community Environmental Monitoring Program should be implemented as means toward ensuring public confidence in the safe operation of the proposed MRS facility.

4.6. A simple and inexpensive procedure to guarantee private property values surrounding the MRS site and along the railroad spur serving the MRS facility should be implemented by DOE.

5. The MRS may be perceived as a "nuclear waste dump." DOE's environmental record has adversely impacted the regional and national image of Oak Ridge. Although the "waste dump" label already given the proposed MRS by many throughout the state can be proven erroneous, it exacerbates the problems Oak Ridge now experiences in maintaining its image as a high quality community. In accepting the proposed MRS facility, the local governments should be assured that DOE will accept the following recommendations:

5.1. DOE should finance a significant preoperational public education program, beginning upon authorization of the MRS, conducted by the County and City to highlight progress being made by DOE in resolving environmental problems and to promote the communities' favorable quality of life.

5.2. Upon authorization of the MRS, DOE should construct, support, and promote new exhibits in the American Museum of Science and Energy and provide adequate funding for programs explaining MRS and its role in the integrated nuclear waste system. An aggressive program should also be mounted to better explain existing DOE Oak Ridge facilities.

5.3. The MRS facility itself should be well designed and landscaped so as to be aesthetically pleasing.

5.4. As part of the MRS, DOE should construct, staff, operate, and promote a visitor's center for the purpose of explaining MRS and its role in the integrated nuclear waste system.

RESOLUTION

WHEREAS, the Department of Energy (DOE) has proposed the construction of an integral Monitored Retrievable Storage (MRS) facility in the Roane County portion of Oak Ridge, Tennessee; and

WHEREAS, the Clinch River MRS Task Force was appointed in July 1985 by the Roane County Executive and the Oak Ridge City Council to evaluate the proposed MRS facility; and

WHEREAS, the Task Force, made up of three study groups, has spent several months of detailed study and careful evaluation of the MRS concept, including numerous public meetings, and has conducted site visits to relevant facilities; and

WHEREAS, the Task Force has determined that the facility could be safely built and operated in the Roane County portion of Oak Ridge, provided certain concerns are addressed and impacts mitigated; and

WHEREAS, the MRS would not be seen as a beneficial addition to the region's economic base unless DOE is required by the Congress of the United States to comply with stringent but reasonable conditions equivalent to those recommended by the Task Force.

NOW, THEREFORE, BE IT RESOLVED BY THE MEMBERS OF CLINCH RIVER MRS TASK FORCE:

That the attached summary of the study groups' reports on the proposed Monitored Retrievable Storage facility is hereby adopted as the official position of the Clinch River MRS Task Force.

BE IT FURTHER RESOLVED that the Roane County Commission and the Oak Ridge City Council are encouraged to adopt and support the recommendations in this summary as the official position of the two local governments.

BE IT FURTHER RESOLVED that the State of Tennessee, the Department of Energy, and the Congress of the United States are encouraged to incorporate and support the position of the Clinch River MRS Task Force within the MRS authorizing legislation and agreements mandated therein.

This Resolution is approved by the Clinch River MRS Task Force on the 10th day of October 1985.

Kenneth Yager

Kenneth E. Yager
County Executive - Roane County
Executive Committee
Clinch River MRS Task Force

Roy F. Pruett

Roy F. Pruett
Mayor - City of Oak Ridge
Executive Committee
Clinch River MRS Task Force

Robert Peelle

Robert W. Peelle
Chairman
Environmental Study Group

Larry M. Dickens

Larry M. Dickens
Chairman
Socioeconomic Study Group

Shirley P. Hendrix

Shirley P. Hendrix
Chairman
Transportation Study Group

NUMBER 10-154-85

RESOLUTION

WHEREAS, the Nuclear Waste Policy Act of 1982 calls upon the Department of Energy (DOE) to prepare recommendations regarding the need for and location of Monitored Retrievable Storage (MRS) facilities to handle spent nuclear fuel destined for permanent repositories, and

WHEREAS, the Clinch River MRS Task Force has been jointly appointed by the Roane County Executive and the City Council of Oak Ridge to evaluate the MRS facility proposed by DOE to be constructed in the Roane County portion of Oak Ridge, and

WHEREAS, for several months the Clinch River MRS Task Force has carefully evaluated the proposal and has arrived at a position on the MRS which identifies the communities' concerns, describes the potential impacts of the proposed facility, and recommends appropriate mitigative measures, and

WHEREAS, it is the position of the Clinch River MRS Task Force that, if DOE is required by Congress to comply with those stringent but reasonable mitigative measures, the proposed MRS could be safely built and operated and would constitute a beneficial addition to the region's economic base with no harmful effects ensuing.

NOW, THEREFORE, BE IT RESOLVED BY THE MAYOR AND COUNCILMEN OF THE CITY OF OAK RIDGE, TENNESSEE:

That the City Council of Oak Ridge hereby adopts the position of the Clinch River MRS Task Force as its own and encourages the State of Tennessee, the Department of Energy, and the U.S. Congress to support the incorporation of the position into the MRS legislation and associated agreements.

BE IT FURTHER RESOLVED that with the compliance of the conditions set forth in the adopted position, the City Council of Oak Ridge would willingly accept location of the proposed MRS facility within its jurisdictional limits.

BE IT FURTHER RESOLVED that the Clinch River MRS Task Force is hereby authorized to promote with State- and Federal-appointed officials full understanding and consideration of the City's adopted position.

This the 21st day of October 1985.

APPROVED AS TO FORM
AND LEGALITY:

William E. Lantrip
City Attorney

Mayor

Jacquelyn J. Bernard
City Clerk

#1603

OCT 16 1985

IN THE COUNTY COMMISSION FOR ROANE COUNTY, TENNESSEE

A RESOLUTION adopting the recommendations in the October 10 report of the Clinch River MRS Task Force

WHEREAS, the Clinch River MRS Task Force appointed by the Roane County Executive and the Oak Ridge City Council has submitted a report to the governing bodies requesting the adoption of a series of recommendations.

NOW, THEREFORE, BE IT RESOLVED that the Board of Commissioners of Roane County, meeting in special session on October 22, 1985, does adopt the recommendations in the October 10 report of the Clinch River MRS Task Force. Roane County thereby accepts the position that based on information to date, the MRS facility could be acceptable to Roane County and provide a net economic benefit to our citizens if conditions equivalent to those in the Task Force Report are securely satisfied by the authorizing legislation and intergovernmental agreements provided for by that legislation.

BE IT FURTHER RESOLVED that the State of Tennessee and the Tennessee Congressional Delegation are asked to help obtain adoption of the requested conditions.

BE IT FURTHER RESOLVED that the State of Tennessee and The Department of Energy are thanked for their strong cooperation with the Clinch River MRS Task Force.

Upon motion of Commissioner Langley, seconded by Commissioner Crews, the following Commissioners voted Aye: Crews, Delaney, Dutton, Ferguson, Hatfield, Hacker, Honeycutt, Housto, Langley, Money, Renfro. (11)

The following Commissioners passed: None

The following Commissioners voted No: None

Thereupon, the County Chairman announced to the Court that said resolution had received a constitutional majority and ordered same spread of record.

APPROVED:

County Chairman

The foregoing resolution was submitted to the County Executive for his consideration this 22 day of Oct., 1985.

ATTESTED:

Dorothy M. Marshall

Dorothy M. Marshall, County Clerk

I [✓ approve]/veto the foregoing resolution this 22 day of Oct., 1985.

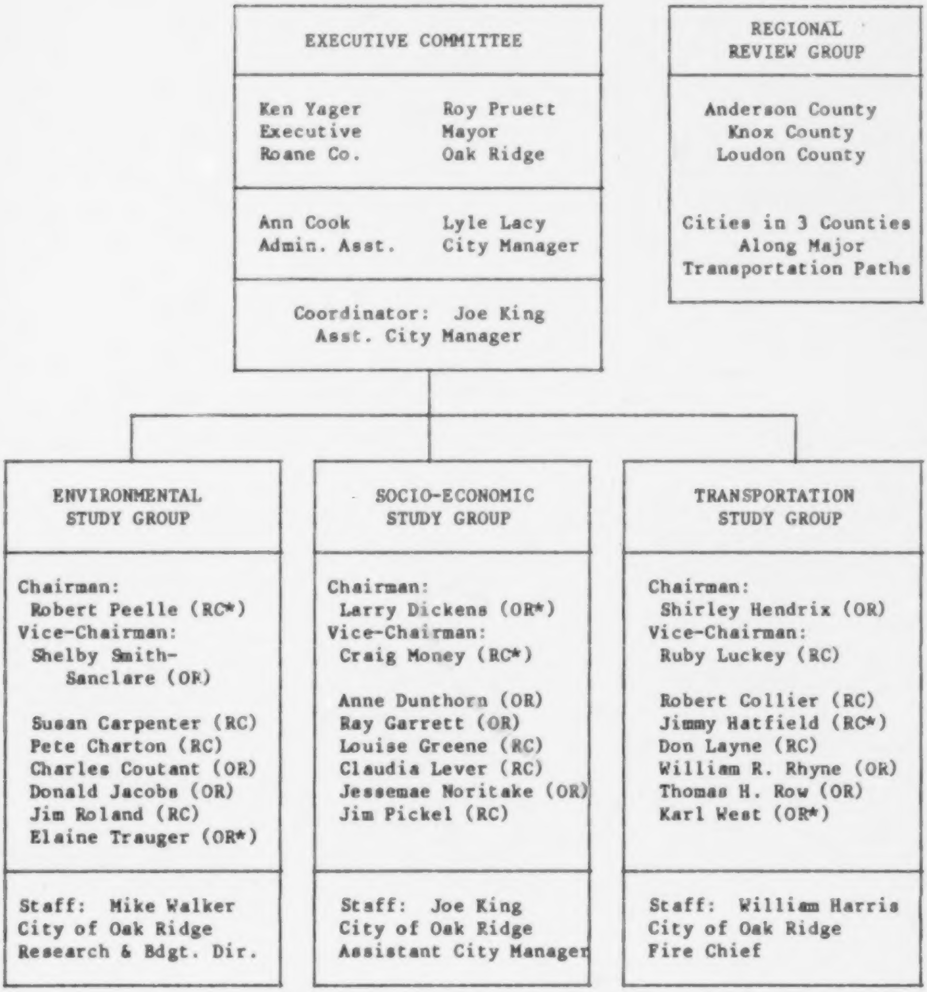
County Executive

STATE OF TENNESSEE
COUNTY OF ROANE
Attest:
Dorothy M. Marshall

SUBMITTED [illegible] PEELLE FOR THE CLINCH RIVER MRS TASK FORCE

Certified a true and correct copy
October 22 19 85
Month Day Year
By Vickie

CLINCH RIVER MRS TASK FORCE



EXECUTIVE COMMITTEE

Ken Yager Executive Roane Co.	Roy Pruett Mayor Oak Ridge
Ann Cook Admin. Asst.	Lyle Lacy City Manager

Coordinator: Joe King
Asst. City Manager

REGIONAL REVIEW GROUP

Anderson County
Knox County
Loudon County

Cities in 3 Counties
Along Major
Transportation Paths

ENVIRONMENTAL STUDY GROUP

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Robert Peelle (RC*)
Vice-Chairman:
Shelby Smith-Sanclare (OR)

Susan Carpenter (RC)
Pete Charton (RC)
Charles Coutant (OR)
Donald Jacobs (OR)
Jim Roland (RC)
Elaine Trauger (OR*)

Staff: Mike Walker
City of Oak Ridge
Research & Bdgt. Dir.

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Vice-Chairman:
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Anne Dunthorn (OR)
Ray Garrett (OR)
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Claudia Lever (RC)
Jessemae Noritake (OR)
Jim Pickel (RC)

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City of Oak Ridge
Assistant City Manager

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Karl West (OR*)

Staff: William Harris
City of Oak Ridge
Fire Chief

(RC = Roane County Member; OR = Oak Ridge Member; * = Elected Legislator)

CLINCH RIVER MRS TASK FORCE

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CLINCH RIVER MRS TASK FORCE

ROANE COUNTY/CITY OF OAK RIDGE , TENNESSEE

615/483-5671 · POST OFFICE BOX 1 · OAK RIDGE , TENNESSEE

January 16, 1986

Mr. Ben C. Rusche, Director
Office of Civilian Radioactive
Waste Management
U.S. Department of Energy
RW-1, Room 54-085
Forrestal Building
Washington, D.C. 20585

Dear Mr. Rusche:

Monitored Retrievable Storage Submission to Congress

On behalf of the Clinch River MRS Task Force, we wish to congratulate your office on the review copy of the three-volume Monitored Retrievable Storage Submission to Congress distributed December 23, 1985. We believe the DOE has been responsive to many of our concerns, requests and recommendations in drafting the submission. It has been our contention that the MRS could be accepted in the Roane County portion of Oak Ridge provided stringent, but reasonable conditions are met. DOE's support of measures necessary to address local and state concerns and mitigate potentially negative impacts of the MRS provides convincing evidence of its intent to pursue responsible corporate citizenship. We are anxious to learn precisely how these measures will be authorized and implemented.

Our Task Force has reviewed the three-volume submission. In finalizing your reports for submittal to Congress in February, we urge you to consider the enclosed comments. Many relate to editing suggestions and could easily be incorporated into your final draft; others are more substantive in nature. We wish to highlight four items which we consider most important.

Impact Assistance and Tax Equivalent Payments. It is the firm position of the Clinch River MRS Task Force that the State of Tennessee, Roane County, and the City of Oak Ridge must receive annual payments equal to the taxes that would be paid on the MRS were it privately owned, valued at $1 billion, and fully taxed. To mitigate the negative impacts of the MRS, preoperational assistance payments equivalent to such amounts would have to be paid annually beginning with authorization of the facility. Your proposal supports this position, but could be clarified somewhat.

State and Local Oversight of MRS Operations. The Clinch River MRS Task Force applauds DOE's willingness to subject the MRS to the oversight of the proposed MRS Steering Committee. Such a committee could provide a model for the siting of nuclear and hazardous materials handling facilities of all types. The Task

Force recommended an MRS Environment, Safety, and Health Review Board to provide citizen input on a more limited basis than that envisioned in your proposal. As noted in our comments, the approach you have proposed may on balance prove superior to that we suggested. However, we feel state and local representation must receive stronger emphasis than that reflected in your draft proposal. The primary impact of the MRS would be on the local area. Consequently, the primary objective we would hope to accomplish in creation of such a committee is that of providing direct local oversight of MRS planning, construction and operations. While participation of representatives named by DOE and the nuclear utilities would strengthen the committee, the majority of appointed members should be residents of the region and represent State and local interests.

Assurances That Commitments Would Be Met. With regard to the siting of a repository, the Nuclear Waste Policy Act (NWPA) schedule allows a potential host state ample time to negotiate "consultation and cooperation" (C & C) agreements before its opportunity to issue a "notice of disapproval" expires. This will benefit both the host state and DOE in that mitigation of potentially adverse impacts can be considered and negotiated before the state determines whether the issuance of a notice of disapproval is necessary. It has been the experience of the Task Force that, given sufficient time and the willingness of all parties to constructively address problems identified, mitigation of negative impacts relating to the MRS could be similarly accomplished.

The MRS has not yet been formally proposed to Congress, let alone authorized. It was as recently as April 1985 that Tennessee was identified as the location for the MRS. Conceptualization of MRS functions and identification of MRS impacts and benefits have only been finalized during the last of the ensuing months. Given this situation, it is inappropriate that the deadline for the State's notice of disapproval is 60 days after the MRS proposal is presented to Congress, as is currently specified in the NWPA. With this in mind, the Task Force recommended that the MRS authorizing legislation provide for the 60-day period for issuance of a "notice of disapproval" begin six months after C & C agreement negotiations commence.

The Task Force urges DOE to consider means within its own authority of providing assurances to the State and potential host communities that MRS commitments will be honored. A memorandum of understanding (MOU) jointly agreed to by DOE, the State, Roane County, and the City of Oak Ridge should be considered documenting DOE's commitment to pursuit of the objectives outlined in its submission to Congress. The MOU should address all actions that can be implemented administratively without specific Congressional authority; for example, linkage of the receipt of spent fuel at the MRS to progress made on construction of the permanent repository. In our view, such a document formally agreed to by DOE, the State, and the host communities at the time the MRS submission is presented to Congress would ease concerns regarding the likelihood that proposed commitments would be honored.

Negative Regional Impacts of the MRS. In our opinion, the analysis of the proposed MRS undertaken by numerous State agencies acting under the direction of Governor Alexander's Safe Growth Cabinet Council indicates that the facility can be safely constructed and operated. Studies conducted suggest that the MRS could be effectively regulated by those agencies responsible for environmental and transportation safety. Your proposal adequately addresses the socioeconomic impacts of the facility on the host communities; in fact, assuming the mitigative measures proposed are implemented, the MRS will provide a significant net benefit to the local economy. However, potentially negative socioeconomic impacts on the multi-county region beyond Roane County and Oak Ridge identified in the State's analysis remain unaddressed in your proposal. We limited our analysis of impacts to the immediate area but are concerned about the region as well. While the Clinch River MRS Task Force cannot speak for the Governor or State Legislature on this issue, we do contend that means are available to mitigate regional impacts beyond our area. We urge consideration of the following:

Assist the State in Industrial and Tourist Promotion. The University of Tennessee's Center for Business and Economic Research has documented potentially adverse impacts of the MRS on industrial and tourist recruitment in the region. The Task Force recommends provision of direct financial assistance to the State to assist in industrial and tourist promotion efforts. Additionally, it recommends that DOE designate the State as a prime location for its conferences and training sessions and encourage other federal agencies to do likewise. This would tend to offset any tourist revenues lost by virtue of location of the MRS in the Oak Ridge area.

Assist in Development of the Tennessee Technology Corridor. The Oak Ridge/Knoxville metropolitan area, specifically the Pellissippi Parkway (SR-162) which links Oak Ridge to I-40/I-75, has been designated by the State as the Tennessee Technology Corridor. Major existing components of the Corridor concept include the Oak Ridge National Laboratory and the other DOE facilities, the University of Tennessee, and the Tennessee Valley Authority. It is hoped that these institutions will provide the foundation upon which high technology industrial expansion throughout the region will be achieved. The Clinch River MRS Task Force recommends that DOE support development of the Corridor through the following supplemental actions:

- Provision of limited grants to the Tennessee Technology Foundation to assist in infrastructure improvements and industrial recruitment activities;
- Provision of limited grants to the University of Tennessee to extend business services to emerging entrepreneurs seeking to establish firms in the Corridor;
- Assistance in the completion of the Pellissippi Parkway extensions to the Oak Ridge Turnpike (SR-95) and Alcoa Highway (SR-73/US-129);

- Utilization of the Roane State Community College/State Technical Institute-Knoxville facilities currently under construction within the Corridor for MRS-related training programs; and

- Support of the general aviation airport facility now being considered for the Oak Ridge area.

Facilitate the Implementation of "Volume IV." The Task Force would argue that DOE could more than offset any negative socioeconomic impacts of the MRS through Martin Marietta's implementation of community involvement programs outlined in "Volume IV" of its contract proposal. In seeking a primary contractor to replace Union Carbide two years ago, DOE affirmed its continuing program interest in assisting expansion of the region's industrial base. Firms responding to DOE's request for proposals were expected to share DOE's interest in this regard and submit in "Volume IV" of their proposals corporate plans for community involvement. The Martin Marietta Corporation, the primary contractor selected, submitted a proposal featuring the following commitments:

- Investment of 10 percent of its annual fee as venture capital;

- Administration of an aggressive technology transfer program;

- Placement of $15 million of corporate procurement in East Tennessee;

- Construction of a privately-owned headquarters building in the local private sector;

- Development of a large, multipurpose industrial park in Oak Ridge;

- Investment of over $1 million locally in joint university/government/industry research;

- Sponsorship of a Center for Manufacturing Systems Engineering;

- Promotion of industry sponsorship of the American Museum of Science and Energy; and

- Substantial contribution to local educational, cultural, civic, health, and welfare organizations.

The successful implementation of these programs would significantly offset potentially adverse regional socioeconomic impacts of the MRS. DOE's reaffirmation of its interest in broadened industrial development as demonstrated through its support of Martin Marietta's "Volume IV" programs is essential in this regard. Adoption of a similar community involvement policy for MRS contractors would assure continued economic benefits to the region.

In closing, let us once again congratulate DOE on an excellent review draft Monitored Retrievable Storage Submission to Congress. It is our belief that incorporation of the modifications contained herein, as well as those constructive suggestions offered by other interested parties, will further strengthen the submission. DOE has presented convincing evidence that the MRS could be safely constructed and operated in the Roane County portion of Oak Ridge, Tennessee. Favorable consideration by Congress of those measures proposed by DOE to mitigate the potentially negative impacts of the MRS will ensure that the facility provides net economic benefit to the local community. Consideration of supplemental items included herein would extend these benefits to the region and state.

Sincerely,

Ken Yager

Kenneth E. Yager
County Executive, Roane County
Executive Committee
Clinch River MRS Task Force

Roy F. Pruett

Roy F. Pruett
Mayor, City of Oak Ridge
Executive Committee
Clinch River Mrs Task Force

Robert W. Peelle

Robert W. Peelle
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Environmental Study Group

Larry M. Dickens

Larry M. Dickens
Chairman
Socioeconomic Study Group

Shirley P. Hendrix

Shirley P. Hendrix
Chairman
Transportation Study Group

Enclosure

Comments and Suggestions

Relating to DOE's

Monitored Retrievable Storage Submission to Congress

VOLUME 1: Proposal

Section 3.1, Page 11, Paragraph 1. Correct the statement, "The preferred site for an MRS facility is 25 miles west of Knoxville, Tennessee" to read, "The preferred site for an MRS facility is in the Roane County portion of the City of Oak Ridge, Tennessee, 25 miles west of Knoxville."

Section 3.1, Page 11, Paragraph 2. Correct the statement, ". . . and the Clinch River MRS Task Force, which represents the local communities in the area of the preferred site . . ." to read, ". . . and the Clinch River MRS Task Force, which represents the local governments sharing jurisdiction of the preferred site area."

Section 3.2.1, Page 11, Paragraph 4. Correct the statement, "The MRS facility would be constructed on the Clinch River site in the eastern portion of Roane County, 25 miles west of Knoxville and nine miles southwest of the center of the city of Oak Ridge, Tennessee." to read, "The MRS facility would be constructed on the Clinch River site in the Roane County portion of the City of Oak Ridge, Tennessee, 25 miles west of Knoxville.

Section 3.2.2, Page 15, Last Paragraph. The proposal notes that compacted nonfuel-bearing assembly scrap material will be shipped to the repository. Because of the importance of assuring the residents of the state that no waste materials associated with the MRS would remain here permanently, it is the position of the Task Force that all secondary waste items should be disposed of outside Tennessee. This would include such items as contaminated gloves and protective clothing.

Section 3.2.5, Page 20, Paragraph 2. The proposal does not address the Task Force recommendation that a Community Environmental Monitoring Program similar to the one operated at EPA at DOE's Nevada Test Site be established well in advance of MRS operations. It remains the Task Force view that such a program would provide a publicly accepted means for testing and documenting the environmental protection measures utilized at the facility.

Section 3.2.5, Page 20, Paragraph 3. It is noted that the MRS will meet all applicable environmental and land-use requirements of the federal government, the State of Tennessee, and Roane County. Adherence to the City of Oak Ridge codes and regulations should also be referenced.

Section 3.5.3, Page 27, Last Paragraph. The linkage proposed by DOE between the commencement of MRS operations and progress on completion of the permanent geologic repository is even stronger than that suggested by the Task Force. DOE should be commended for making such a commitment. It is possible, however, that even after construction of the repository is authorized by the Nuclear Regulatory Commission, completion of that facility could be significantly delayed or the project terminated altogether. The Task Force, seeking assurances that fuel assemblies not remain at the MRS indefinitely, has taken the position that (1) no more than 10,000 metric tons of spent fuel should be received at the MRS before out-shipments of consolidated fuel rods to the permanent repository begin and (2) that any spent fuel stored at the MRS longer than 15 years should be subjected to a significant "overdue-removal penalty" levied by the State of Tennessee.

On a closely related issue, DOE recommends that the total MRS storage capacity be limited to 15,000 MTU. The Task Force feels that this limitation would be more meaningful if any future attempt to expand the storage capacity not be simply authorized through NRC licensing procedures. It is for this reason that the Task Force position calls for any proposed extension beyond the 15,000 MTU currently envisioned to be subject to the same review and notice of disapproval procedures followed in the initial authorization of the MRS.

Section 4.1.1, Pages 30 - 32. The Task Force is appreciative of DOE's positive response to the need for some local oversight of MRS planning, operations, and decommissioning. The structure and range of responsibilities of DOE's proposed "MRS Steering Committee" differ from those of the "MRS Environment, Safety, and Health Review Board" recommended by the Task Force. While the approach proposed by DOE may on balance prove superior, the Task Force is concerned that local oversight function is weakened. The following modifications are therefore suggested.

- DOE proposes that the chairman of the MRS Steering Committee be named by DOE in consultation with the Governor of Tennessee. The Task Force feels the reverse would be more appropriate; i.e., the chairman shall be named by the Governor in consultation with DOE.
- The member representing other public interests shall be a resident of the five-county immediate impact area designated in the Environmental Assessment (Anderson, Knox, Loudon, Roane, and Morgan Counties) and appointed by the State.
- A majority of the Steering Committee's membership shall be residents of the State of Tennessee.
- A majority of the members of appointed subcommittees shall be residents of the five-county immediate impact area.
- Chairmen of the appointed subcommittees shall be residents of Roane County and/or Oak Ridge.
- The number of Steering Committee appointees representing Roane County and the City of Oak Ridge should be increased to two each. This would increase the size of the Steering Committee to 11.
- The Task Force recommends that all meetings of the Steering Committee be open to the public.

Section 4.1.1, Page 32, Paragraph 2. The first three sentences which now read, "This subcommittee would recommend and review policies and oversee the execution of programs representing financial commitments of the DOE to the State and local community. In particular, it would oversee the development and execution of the measures for financial assistance described in Section 4.3 of this proposal. These include measures for preventing or mitigating the impacts. . . ." should be amended to read, "This subcommittee would recommend and review policies and measures for preventing or mitigating the impacts. . . ."

The Task Force understands that the description of subcommittees and their functions are provided for illustrative purposes; the final organization plan of the MRS Steering Committee will be an item formalized through the Consultation and Cooperation (C & C) agreements. With regard to the functions described for the "Subcommittee on Financial Matters," the Task Force feels that items relating to impact assistance and grants equivalent to taxes paid to the MRS host jurisdictions and the State should be established through direct agreements and not be subject to oversight by any third party. The role of a subcommittee regarding the items described in Section 4.3 of the proposal should therefore be limited to that of an advisory panel.

Section 4.1.2, Page 32, Paragraph 4. As the MRS has not yet been authorized, it is inappropriate that the deadline for the State's notice of disapproval is 60 days after the MRS proposal is presented to Congress as currently specified in the NWPA. The Task Force strongly recommends that the MRS authorizing legislation provide for the 60-day notice of disapproval period to begin six months after C & C agreement negotiations commence.

Section 4.1.2, Page 33, Paragraph 7. The Clinch River MRS Task Force recognizes that the NWPA calls for C & C agreements between DOE and the states hosting its facilities. However, the Task Force contends that certain issues of strictly local concern should be subject to direct agreements between DOE and the local governments. The communities hosting the MRS must be assured a direct role in resolving local issues. The leading sentence of this paragraph, "It would be up to the State of Tennessee to ensure that local interests are accommodated in the consultation-and-cooperation agreement." appears to absolve DOE from any responsibility to see that local concerns are addressed. While we agree it would be inappropriate for DOE to interject itself between the State of Tennessee and Roane County or the City of Oak Ridge, the Task Force feels it important for the proper tone to be set in the proposal narrative. The leading sentence of this paragraph should be deleted.

Section 4.2.2, Page 35, Paragraph 2. The transportation items listed will require expenditures on the part of the State and local governments. It is the position of the Task Force that funding would be provided by DOE. The following changes are suggested:

Item 1. The item should be concluded as follows: "The DOE will support the funding of indicated road improvements without affecting federal funds regularly allocated the State for transportation system improvements."

Item 3. The first sentence which reads, "Assistance will be provided to the State of Tennessee. . . ." should be modified to read, "Assistance and sufficient funding will be provided to the State of Tennessee. . . ."

The proposal does not specifically address the Task Force's Transportation Study Group recommendation that a training center for emergency responders similar to that operated in Nevada be established in Tennessee. Such a center located here would improve accessibility to training for eastern corridor states, as well as relieve the burden on the Nevada facility.

Section 4.2.4, Page 36, Last Paragraph. While the Task Force understands that environmental cleanup activities scheduled for the Oak Ridge Reservation over the coming years will be subject to Congressional authorization of funds, it considers success in bringing existing DOE facilities into compliance with applicable State and federal environmental regulations prior to commencement of MRS operations to be of critical importance. If the issue of so doing is to be addressed separately by the DOE Oak Ridge Operations (DOE/ORO) Office, the Task Force requests that a memorandum from the Secretary of Energy outlining such plans, schedules and commitments accompany and be made a part of the final draft of the Monitored Retrievable Storage Submission to Congress.

Section 4.3.1, Page 38, Paragraph 5. It is important that all concerned understand that impact assistance payments made during the preoperational phase to Roane County and Oak Ridge would equal taxes paid on a $1 billion operational MRS facility. It is suggested that the leading sentence be modified to read, "It is proposed that the payments made annually during the preoperational phase to the State and local governments would equal the taxes and grants equivalent to taxes paid to those governments by a fully operational MRS facility valued at $1 billion."

VOLUME 2: Environmental Assessment

The Task Force is appreciative of DOE's willingness to make corrections suggested following State and local review of the initial Environmental Assessment draft.

Executive Overview, Page v, First Paragraph. The last phrase in the first sentence should read, ". . . at the Clinch River site in the Roane County portion of Oak Ridge, Tennesse.

Executive Overview, Page vi, Last Full Paragraph. The paragraph does not address the fact that the Oak Ridge area is heavily impacted by the federal government. The socioeconomic impacts of the MRS extend beyond the loss of a site for industrial development purposes.

Section 6.2.9.2, Page 6.65, Paragraph 4. Both SR 95 and SR 58 are experiencing problems with regard to traffic congestion. It is the opinion of the Task Force that both will require upgrading if they are designated primary routes for spent fuel shipments.

Various Maps. While earlier maps have been corrected to accurately depict the primary and secondary MRS sites as being within the Oak Ridge city limits, the labeling of the maps remains misleading. The highlighted areas now labeled "Oak Ridge" should be modified to indicate "Population Center" or "Urbanized Area."

VOLUME 3: Program Plan

Section 3.7, Page 3.25, Footnote (a). Beyond this footnote, little mention is made of the possibility of use of the MRS in waste retrieval operations. It is the view of the Task Force that such activities should occur only after full consultation with the State and host communities and specific authorization of Congress.

The CHAIRMAN. Mayor, excuse me, if I may interrupt. We have read your statement and would rather have some time for some questions to you.

First of all, let me say I very much agree with you when you say the city must be an active participant in all deliberations. That is intended and we want to ensure that that takes place. We want the citizen environment safety and health review board to be given the substantive powers which you asked for.

Now as far as becoming a de facto permanent repository, I understand the fears on that. All I can tell you is that when the authorization comes down, it will, in fact we have already authorized it at 15,000 metric tons. I do not know that we need an overdue removal penalty. I mean, if that is all that is authorized, then the Government does not have the money with which to go beyond that.

I think the statement by Ben Rusche of having the extra acreage is prudent, not because we plan to increase it, but I mean it may well be that Oak Ridge, that S. 839 will pass, that Oak Ridge will think it is as benign, and the State of Tennessee will think it is benign, as Ben Rusche has described it, no possible danger to anyone in the area.

A lot of jobs connected with it, and indeed the city of Oak Ridge and the State of Tennessee may themselves ask for it to be expanded. But I can tell you that is not my intention. I know in the House they feel very strongly that we should have geologic, in fact the Nuclear Waste Policy Act was a compromise.

One year we had passed legislation, this committee, providing for MRS only. The House thought we ought to have geologic only. And we came together with the Nuclear Waste Policy Act. It was a grand compromise. And I am persuaded in the meantime, as is Ben Rusche, that we ought to have both. That there are advantages of both.

And in any way that I can assure you it is not our intention to make this a de facto permanent facility, but rather to be temporary and we will do everything we can to reassure you on that.

Now this is the first I have heard about Oak Ridge not being the optimal site for the facility siting. That is of course something that addresses itself principally to DOE and Ben Rusche. I mean we do not want to ruin your best site and take the heart out of it. I know the Clinch River site is licensed, which is a significant advantage.

But you are familiar with the provisions of S. 839, and I would, are you familiar with that?

Mr. PRUETT. Yes, sir.

The CHAIRMAN. I think that would be a very appropriate thing to negotiate at that point, if you are willing to do so. You know I believe in fair and adequate compensation, because that is what S. 839 is all about, and that is in addition to payments in lieu.

We provide for the situs governments to be compensated separately in the sense that at least a third must go to local governments, and a percentage in the breakdown of how they are compensated must be provided for in the plan under S. 839. So the time to provide for that formula is if indeed Tennessee or Oak Ridge comes in and accepts the deal, then you do it as a package at that time and that cannot later be altered.

Now in terms of the State's veto, obviously a State veto and S. 839 are inconsistent. If we provide, as we do for maximum State input, maximum local input, so that you are there at the design, funded at a level so that you can have access to experts, and you have got access to good people at Oak Ridge, I have been very impressed with the government in Oak Ridge. You have real sophistication there.

But you can further provide for hiring of experts with this panel which we provide for under S. 839. Then I would hope we would obviate the necessity in your mind for a veto. But the veto and the scheme of compensation are really at odds with one another.

I would urge this to you, as I said this morning, that the time to, I do not know whether we can pass S. 839. I suspect we can. I do not know whether it will be amended or not. But I suspect we can because of the comments I get from my colleagues.

If I were in the shoes of Oak Ridge and the State of Tennessee I think I would try to find a way to assure myself that this could be done safely. I personally feel very confident that Ben Rusche is right. You really need to go over there to Marcoule and Forsmark and Oskarshamn and La Hague and see how they are doing it over there.

I mean, nobody is excited about it. We walked right over the highest level waste in France and looked right down in the pools. You could see the rods down there. You know, for the scientists, it is not a challenging thing to do it safely. The challenge is to reassure the public.

But if I were the State of Tennessee I would say, look, you have got in place a Nuclear Waste Policy Act, it says you are going to have an MRS, and DOE has picked the State of Tennessee. Now I would say, if I were in Tennessee, the chances of getting picked are pretty good, mainly because you are already picked.

And the chances of being able to say, do not put it in my backyard but stop and put it in somebody else's backyard, everybody else then opposes that. That may not be fair and it may be cruel and all of those things, but I mean those are the political facts of life. You are chosen, and nobody else is, and so they do not want to upset the process to choose somebody else. So the chances are you are going to get chosen.

Now at least for the purpose of backing S. 839, I would say, let us keep our right to oppose this all the way to the bitter end, but in the meantime just in case we change our mind let us put in place S. 839 and see if we can get $50 million a year, because I would suspect that $50 million for the State of Tennessee, which would be almost $17 million a year for local jurisdictions, would be of significant use. I hope the State of Tennessee can do that.

I must say I was impressed by Governor Alexander's, the quality of his opposition, which was not shrill and it was not unreasoned. What he said was, of course, you can store it and transport it safely, he said, but there is a presumed black eye.

In effect what he was doing was saying, there is sort of an emotional reaction to nuclear waste. And I think that is a legitimate concern, but I am glad that he did recognize that it could be done safely. So I just mention those things to you and hope Tennessee can come around to that view.

I see we have a vote on right now. It might be an appropriate time to stop and go vote. So we will have a five- or ten- minute recess.

[Recess taken.]

The **CHAIRMAN**. I am very sorry for the interruption. Mr. Yager, please proceed.

STATEMENT OF KENNETH E. YAGER, COUNTY EXECUTIVE, ROANE COUNTY, TN

Mr. **YAGER**. Chairman Johnston, distinguished committee members, staff:

I am Ken Yager. I am the county executive for Roane County, TN, which is the preferred site for the proposed Monitored Retrieval Storage facility, or the MRS. And I am submitting into the record additional written testimony which was written largely by the Honorable Robert Peele, who is sitting here, who is a member of the Roane County Board of Commissioners, our local legislative body.

The premise of my remarks is that the Department of Energy proposal for the MRS in our county is unacceptable unless the Congress and the Department of Energy are to be willing partners with the local communities.

I think that you have read or been told that Roane County and Oak Ridge support the MRS, but this is not entirely the case. Our governments have said, Mr. Chairman, that we believe an MRS can be operated safely and that the facility technically can be functional. But we have not, however, endorsed the concept of an MRS, leaving that as a national policy question which the Congress will decide.

Our considerations have been limited to: one, can an MRS be operated safely, and if so under what conditions; and what would be the impacts of the facility and how might they be mitigated.

Our recommendations on those two points lead me to my earlier comment about being partners with the Congress, because our recommendations can be summed up simply, Mr. Chairman, as local control.

We are exceedingly concerned about the prospect of being trapped in a national squeeze play, caught between a recognized need for a way to deal with nuclear waste and intense political efforts to put that problem in somebody else's back yard.

And if we are to be that back yard, we would ask that the Congress and the Department of Energy recognize our stake in this national effort. We must have an equal role in the process.

That means we must have an extraordinary amount of authority, extraordinary by most standards of federal and local government relationships. We ask you to amend the Nuclear Waste Policy Act to give local governments the authority to negotiate directly with the Department of Energy.

Consultation and cooperation agreements with state governments are necessary and should be included. But our interest in Roane County and Oak Ridge go beyond those of the state of Tennessee.

The Department says it cannot make this recommendation, but it can and should be—that is, the Nuclear Waste Policy Act be amended. If those amendments are made, local governments would insist on two basic principles: that we have equal representation and equal authority with the Federal Government on all matters pertaining to the operation of an MRS.

[The prepared statement of Mr. Yager follows:]

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Senate Energy and Natural Resources Committee

THE MRS PROPOSAL OF THE DEPARTMENT OF ENERGY

Comments by Kenneth E. Yager, County Executive
Roane County, Tennessee
April 29, 1987

Chairman Johnston, distinguished committee members, staff and fellow guests. I am Ken Yager, the County Executive of Roane County, Tennessee, site of the proposed Monitored Retrievable Storage facility (MRS).

I am submitting for insertion into the record additional written testamony by Hon. Robert Peele, member, Roane County Board of Commissioners and myself.

The Department of Energy proposal for an MRS in our county is unacceptable -- unless the Congress and Department of Energy (DOE) are willing to be partners with the local communities.

I suspect some of you have heard, read or been told that the Oak Ridge and Roane County communities support the MRS. That is not entirely the case.

Our local governments have said, and continue to say, that we believe an MRS could be operated safely, that the facility technically can be functional.

We have not, however, endorsed the concept of an MRS. That is a national policy question that the United States Congress will decide.

Our considerations have been limited to: (1) can an MRS be operated safely, and if so under what conditions and (2) what would be the impacts of the facility and how might those be mitigated.

Our recommendations on those two points led me to my earlier comment about being partners with Congress because our recommendations can be summed up simply as: local control.

We are exceedingly concerned about the prospect of being trapped in a national squeeze play -- caught between a recognized need for a way to deal with nuclear waste and intense political efforts to put that problem in someone else's backyard.

If we are to be that backyard, we would ask the Congress, and the Department of Energy recognize our stake in this national effort.

In order to adequately protect ourselves, we must have an equal role in the process. That means we must have an extraordinary amount of authority -- extraordinary by most standards of federal and local government relationships.

We are asking Congress to amend the Nuclear Waste Policy Act (NWPA) to give local governments the authority to negotiate directly with the Department of Energy. Consultation and cooperation agreements with state governments are necessary, and should be concluded, but our interests in Roane County, and Oak Ridge, go beyond those of the state of Tennessee. DOE says it cannot make the recommendation to amend the NWPA.

It can, and should be, amended.

If those amendments are made, the local governments would insist on two basic principles: that we have equal representation, and equal authority, with the federal government on all matters pretaining to the operation of an MRS.

The Clinch River MRS TAsk Force requested a review board, with equal membership for the city, county and state, that would have full access to all information about the MRS operation and the authority to suspend its operations if clear evidence shows a threat to the safety, health or environment of local citizens.

The DOE proposal calls for a steering committee with little local representation, access to a lot of information, but authority to do virtually nothing.

We recognize that adopting the task force recommendations would be a precedent setting move for the federal government, an extraordinary sharing of power. But the federal government is asking our local citizens to take an extraordinary step -- accepting the high level nuclear waste for the entire country, and to do so in a political climate that leads us to believe we are not partners but sacrifices.

We would hope that members of Congress, a body that operates on principles of delicate compromise and balanced interests, could understand and sympathize with our requests for sharing authority.

Checks and balances, an old and much revered part of our governmental history is really what we're talking about.

Another, and equally important, recommendation of the task force calls for annual payments to the local governments that would be equal to property taxes paid by a private facility of equal value, and for DOE to be instructed to negotiate the payments directly with the local governments.

We recognize that our comments propose changes in the way the federal government deals with local government. We are asking for a partnership -- a partnership, frankly that has not occurred in the past. A partnership for tomorrow which will give local government a voice in its own destiny. A partnership that builds trust, the foundation for real progress.

Any community that is the site for a facility such as this, one that is highly technical, requires careful operation and oversight, and most importantly, is perceived to be highly dangerous, should receive the kind of considerations we are seeking.

Only by recognizing the local communities' stake in this national debate can the Congress and local citizens find a workable solution to a critical problem for our nation' future.

Thank you.

The CHAIRMAN. Mr. Yager, if I may interrupt you at that point, I have read your statement. I would like to respond to some of your concerns.

And by the way, that is an excellent statement. You and Mr. Peele do good work.

And I share your concerns. The purpose of S. 839 was really, among other things, to deal with these concerns, not only to give you the money, but we provide for a review panel. A review panel is a seven-member review panel, four of which are to be—two from the state and two from the local governing authorities.

And the three others, one would be from the utilities, those who pay the bill; and another would be the general interest person; and the other would be the chairman, who would be appointed after consultation with the governors.

But in any event, more than half of this review panel would be—would represent the state and the local areas. They would have access to all of the information. The Department of Energy would have to share all documents, all design criteria, and everything else. And the review panel would have the duties of advising the Secretary on matters relating to the proposed repository or MRS, including issues relating to design, construction, operation, and decommissioning, evaluate performance as it is considered appropriate, recommend corrective actions, assist in the presentation of state or affected local areas perspectives to the Secretary, participate in the planning for and review of preoperational data on environmental, demographic, and socioeconomic conditions of the site and the local community.

And the Secretary shall make available promptly any information in the Secretary's possession requested by the panel or its chairman.

The purpose of that is really to make the local people partners in this process. I mean, in advising on the design, on the operation, and on all these other things.

Now, the only thing that I see from your statement that would require us to go further is to write in specific powers, but I do not think we can consistent with 839 in effect give you a veto.

But what we can do is design a mechanism here which gives you maximum input. And to the extent this does not give maximum input, we would like to change it to do so. Have you got any, either you, Mr. Yager, or Mr. Pruett, or Mr. Peele——

Mr. YAGER. Mr. Chairman, I appreciate your comments and do want to answer your question. But if I may, I had another point I wanted to make that your statement raised in my mind, and that has to do with the $50 million.

I am not——of course, we know that the local governments are under this bill guaranteed a third of that. But I think that there needs to be some more precision in the definition of just what you mean by local government, because we have Roane County and Oak Ridge, which will be the situs governments.

We share the jurisdiction over that. But does the definition of local government in this bill include all the other counties between Roane County and Nashville? I think that needs to be a little bit more precise, just what the situs governments are.

The CHAIRMAN. What we are saying is that the affected governments will get at least one-third, and we tried to define in our own minds as we sat in the drafting of this bill—we thought, well, how do we define that? And we realized there is no way to define it, but it would have to be—that would have to be worked out with the State government at the time an agreement is made with DOE.

Mr. YAGER. And that, Mr. Chairman—I apologize if I am interrupting—is why it is so important that the local governments participate in these agreements, and as actual parties to these cooperation and consultation agreements, rather than being a third party beneficiary, because we are going to find that the Department and the State governments are negotiating our futures.

And we may be invited to the banquet hall, but I am not guaranteed that we will have a plate at the table.

The CHAIRMAN. Well, I share your concern. The problem in drafting is, who do you draft in? And you do not want to require that—I mean, if you require that the county and the town—you know, maybe it is outside the city limits of Oak Ridge.

I think in this case the Clinch River site is within the city limits, is it not?

Mr. PRUETT. Both of the sites are.

The CHAIRMAN. And clearly, Oak Ridge is involved, and clearly the county is involved. I do not think the problem is there. The problem is those other counties which feel that they are impacted and to what extent.

I just do not know how we define it. I think we have got to leave that up to the good faith of the State.

And then you have your statutory requirement here of one-third. I mean, if they started saying that the whole State is impacted, therefore we are going to divvy this around to every county, I think you would have the makings of a very good lawsuit.

And besides that, Ben Rusche is going to be fair and is going to protect Oak Ridge and your county. I know that because he is there shaking his head saying yes. Let us get that on the record. Mr. Rusche, would you in fact protect the city of Oak Ridge and the county?

Mr. RUSCHE. We would be very sensitive to their needs.

Mr. PRUETT. Let me add something to that. I think it has been made abundantly clear that, while we have studied the safety aspects of the MRS and we have concluded that it can be operated safely within the corporate limits of Oak Ridge, that is a position not generally shared by the rest of the State.

And it may be that we are not written in, but we could be written out in the application of the State that you are talking about. And that gives us some concern.

If you look at the State and the way the Interstate System traverses the State, we could almost include every county in the State as being impacted by one of those transportation routes. And I personally, personally, would feel more comfortable if the law were written so that that situs government that accepts or is given the facility itself would get that third. I would feel a great deal more comfortable.

The CHAIRMAN. By the situs government, you mean the city?

Mr. PRUETT. The city and the county.

The CHAIRMAN. Now, you have this problem there in Nevada, because the two counties are very close to the line, as I recall, and you might even ingress on one county and have the repository in another if it is in Nevada. I do not know whether we have got that. I think—is that right?

Mr. RUSCHE. Yes.

The CHAIRMAN. If we can find a formula to—maybe we could say that, with respect to the MRS, just define it with respect to the MRS. But then again, we have some other, may have some other candidate places.

Mr. PRUETT. Oak Ridge itself is in two counties.

The CHAIRMAN. Mr. Peele.

Mr. PEELE. Mr. Chairman, in the Roane County testimony there is a brief discussion of this point. It is clear that there is some stigma problem for neighboring counties that are not situs counties, and we believe that—and this was not taken up by the task force, of course, because your bill was not in the hopper then.

But it is the strength of your bill that, in this one-third idea, you provide a way that the neighboring counties, who suffer some disadvantages but will not have any grants in lieu of taxes—you provide a way that they can be compensated for the unknown future of how serious that stigma might turn out to be.

So that is a good feature of your bill. For instance, if the MRS should be sited in Morgan County, we would appreciate being recognized as a neighboring county that would have some loss due to people shunning us, and we would like to have a piece of that $17 million.

You had another question that you wanted to raise about your review board. And was that—I believe you wondered whether that was the same as the health and safety review board that the Clinch River task force spoke of. There is a lot of similarity.

Your review board of S. 839 and the steering committee suggested by DOE in its MRS proposal, both of those are broader proposals. They give, in a sense, more power than the Clinch River task force asked for. But they are not as concentrated to the point of health and safety in the immediate area of the plant.

And for that narrow a question which does not deal with utility policy or overall expenditures from the waste fund and so forth, for that narrower question, we feel it should really be predominantly people from the immediate area, chosen by them, plus some representation chosen by the state, not to control all aspects of MRS operation, but only to have an influence within a preagreed to round.

We asked for authority for that committee to prevent new shipments of spent fuel coming in, but not arbitrarily. Committees do not run plants well. What we are talking about is within preagreed to parameters.

If for some reason the MRS starts having emissions that none of us would have believed possible, then without having to go through a long chain of command we would like that committee to be able to say: OK, do not bring any more waste in until we get this under control and get it fixed up, or whatever is needed by the situation.

We are not asking for arbitrary power or arbitrary veto power for some bunch of locally appointed people, because you cannot, as

I say, run a plant with a committee. This would all be sort of planned in advance.

We are not talking about arbitrary power.

The CHAIRMAN. I think your suggestion is a good one and I think we ought to consider an amendment—and I am glad Ben Rusche is here—that would allow us to do that as part of the agreement that might be affected, because that is the kind of thing that would have to be hammered out.

And frankly, Oak Ridge gets very good marks from all of us in terms of sophistication and scientific expertise. I do not think you would have any trouble, if we provide for it in such an amendment, getting together and providing those kind of—the local group.

I mean, if it was Oak Ridge, I think Ben Rusche would welcome a joint hand at the controls in terms of emission standards, those kinds of things. Would that be any problem, Mr. Rusche?

Mr. RUSCHE. I think not. We envisioned something of that sort in the proposal that we made. I think it is difficult to prescribe before the fact. It has to be arrived at as a result of some negotiation and understanding. I think the important point, if I might suggest, Mr. Chairman, is that in all of these factors I think that the Congress would look at granting authority and giving direction to DOE to address these issues.

Much of the matter might be taken care of, and I think it is going to be very hard to tell before the fact just how you take care of it.

The CHAIRMAN. In other words, you think that an amendment to give DOE the authority——

Mr. RUSCHE. Or in the language that you attach to the MRS in preparing approval for the MRS, you could perhaps do this.

The CHAIRMAN. But we would like to be able to give it binding effect, allow you to confect an agreement with the local community which, when agreed to by both parties, then becomes binding.

Mr. RUSCHE. Yes.

The CHAIRMAN. So that the local community knows that they have—

Mr. RUSCHE. Not unilateral action on our part, but a two-party action.

The CHAIRMAN. Well, we will try to put together such an amendment, and we would like you-all's input on it. In effect what it would say is that in contracting with DOE that you would have—the DOE is authorized to enter into a binding agreement with divisions of local government concerning the—I guess it would be the operation of the MRS, and to give that agreement binding authority.

Mr. YAGER. If I might presumptuously suggest, Mr. Chairman, that it not be as authorized, but shall.

The CHAIRMAN. We can say they shall enter into an agreement. We do not tell them what to enter. But in any event, they would have the authority to enter into a binding agreement, so that when you sign on the dotted line you have got joint authority to operate.

We really want to give, and indeed to require, maximum local input. What we want to do is avoid a veto situation like we have got on some of those—some of the plants like Shoreham, where you have got what in effect is a veto under the guise of police powers.

We do not want to authorize that.

Mr. PRUETT. Mr. Chairman, I would like to revisit one point that you made a few minutes ago. We start off by saying the preferred Oak Ridge site is not the optimal site. And lest the wrong impression be left, both the sites that are in Oak Ridge are within a couple of miles of one another.

The site that the committee looked at, the task force looked at, was the Clinch River breeder site, and most of the work was done on that site, because of the environmental work that had been accomplished there.

It was found that the MRS could be operated safely on either of the two sites. The second site is presently owned by DOE, which would take that site and leave us our prime industrial site. And I guess we put that in there as an industrial opportunity for the community itself.

The CHAIRMAN. Well, Mayor, we will certainly try to accommodate you on that. I think it may be that the problem of the slight delay—but I hope Mr. Rusche can accommodate that. I do not want to bind him to that.

Mr. RUSCHE. Let us talk.

The CHAIRMAN. Mr. Rusche says let us talk.

I want to congratulate this panel. You have been very constructive. We have already figured some amendments we want to make to this, and I want to invite you further to write or to call me or the staff as ideas occur to you on this.

By negotiating in effect with us, by being constructive in the process, you are not making yourself more liable to being chosen. I want to tell that to you and to all the others. You simply ensure that, if Oak Ridge is chosen, that it will be chosen under the very best of circumstances, and I hope with a very substantial benefit package that the town of Oak Ridge and the county will share generously in.

I have not put a pencil to what $16⅔ million a year would do to a local county or city, but I would think that it ought to do some wonderful things for education and other local needs.

Mr. PEELE. We might be able to put chemicals in our chemistry labs in high school.

Mr. YAGER. Under the present bill, we do not know if we will get the full 16. But I appreciate your willingness to look at that.

The CHAIRMAN. Well, in your case I would think that you ought to really get the full 16 or pretty close to it, and I would think if the state—I mean, this is just my offhand thinking. The bill does not require this.

But to the extent that the state thinks somebody else along the corridor is having an impact to it, I think they could take that out of their two-thirds share. But we cannot dictate exactly——

Mr. PRUETT. Would you ask Mr. Rusche to write that in?

The CHAIRMAN. I think Mr. Rusche is going to be very sympathetic to all of your needs and desires in Oak Ridge.

Gentlemen, I want to——

Mr. PRUETT. Mr. Rusche has been a true friend through all of this, the whole organization. We compliment them for our cooperation.

Mr. YAGER. I concur.

Mr. PEELE. Mr. Chairman, without taking too much of your time, there is one problem I foresee as the task force, I think, reconvenes to look at the DOE proposal that is now definite.

And consider the things we have heard today and in the newspaper about the possibilities of longer storage at an MRS and a greater capacity, which was not something that we considered. There is no doubt that the conditioned acceptance that came out of the study group I was chairman of in the task force and went to the governmental body, there is no question that that was with the idea of the limited storage and a typical storage time of five or ten years, not 30 or 40, at the MRS.

I would not want to say that when we studied the other question we would come up with a more negative conclusion. I only want to say that we do not know. We heard no testimony, if you wish, about the safety of storage over a longer period.

So far as I know, the DOE studies of MRS casks are, I learned today, perhaps a 50-year design life. But the main consideration was for a much shorter period. I do not believe the NRC or National Academy studies yet have thought about the question of a longer period, at least not recently.

It might change the design. It might be easy to accommodate. But I guess from the local government point of view we do not know. We have not heard information on it, and certainly we have not developed any consensus on that long and big MRS, as opposed to the short and small MRS which is in the DOE proposal.

So as we develop a consensus locally, we will keep everyone informed. But that is harder, and we have to think harder than we did before.

The CHAIRMAN. We are not thinking here on the committee—there may be one or two individual members who would throw an offhand comment about that. But I can tell you it is not our thought to go beyond the 15,000 metric tons. If that should be done, it would be done way far in the future by a different Congress, and probably—or maybe, you may still be the same Mayor and the same Board of Commissioners, but us on the committee, we would be long gone.

And who can say what they are going to do in the next century? But that is not our secret plan, believe me. If it was, we could not pass it. I mean, we have——

Mr. PEELE. That is important for people to know. They do not understand that.

The CHAIRMAN. Well, I want to assure you of that. We have a law that has been passed after 4 years of debate, and it is a grand compromise and it is now signed onto by the Department of Energy.

I mean, they are—because they have to, it is the law of the land. But in addition to that, they believe in it. They believe in this complete system. The MRS is a part, and you flow through the MRS to the permanent repository.

There will be people with the permanent repository that will think, well, it is all going to be in one repository. You know, you are going to have those fears. But that is not the plan. There is no secret agenda to do that.

We are planning for 15,000 metric tons in the MRS, and I would bet my bottom dollar on the fact that that is all you are going to get this century. As I say, next century who can say? But this century I would not worry at all.

Mr. PRUETT. Unfortunately, Senator Ford's suggestion that we hitch up our britches and get ready for 70,000 tons is going to have some very serious, very negative impacts on the study group, and I can almost promise you that.

The CHAIRMAN. Well, that is why I immediately responded that the rest of us are not thinking about that. And not to speak for Senator Ford, who speaks very well for himself, but I believe that was an offhand comment rather than a studied study of what the plan of this Committee or the Congress or the Department of Energy is, because I know of no such plan.

And as I say, I would bet my bottom dollar that that is not the case.

Again, gentlemen, I want to thank you very much for a very constructive hearing. I would be delighted to hear from you in the coming weeks and months on any suggestions you have on legislation, or if Rusche no longer is cooperative with you we would be glad to help you beat up on him as well.

Thank you very much, gentlemen.

Finally, we have a public witness panel with: William W. Berry, chairman and chief executive officer of Virginia Power, from Richmond; Peter Bradford, who is president of the National Association of Regulatory Utility Commissioners, who has been a valued witness before this committee before; and Brooks Yeager, Washington representative of the Sierra Club and another valued witness before this committee.

Gentlemen, we are very pleased to have all of you here and look forward to your testimony.

Mr. Berry, would you begin, please.

STATEMENT OF WILLIAM W. BERRY, CHAIRMAN, VIRGINIA POWER

Mr. BERRY. I will summarize my summary in the interest of time.

I am chairman of Virginia Power and chair of the Edison Electric Institute Policy Committee on Government Affairs. So I am appearing on behalf of all the electric utilities with nuclear energy programs, who are the financial supporters of this program through their customers.

In the best interest of implementing the act, I urge Congress to authorize, fund, and not restrict the use of the monitored retrieval storage facility. This would be a large step towards the goal of meeting the national need for a high level radioactive waste disposal system, and the only means by which DOE can fulfil its statutory and contractual obligations to take spent fuel by January 31, 1998.

The electric utility industry unequivocally supports the MRS, and I cannot emphasize that enough. The industry supports the development of the MRS as an integral part of the repository system.

However, the MRS is not an acceptable long term disposal solution. That can only be accomplished in a deep underground repository. We therefore support DOE's March 1987 proposal to Congress for authorization and funding of the MRS facility, but we urge you not to accept DOE's recommendation to restrict the startup of the facility by linking it to the receipt of a first repository construction authorization.

Doing so would only call into question the availability of the MRS for fulfilling the government's contract with electric utilities.

The proposal also recommends that Congress authorize substantial benefits to the MRS host State and local communities. These provisions are appropriate steps toward the needed incentives for assisting implementation of the Waste Policy Act.

However, the recently proposed S. 839 would offer much greater incentives to the State or Indian tribe that agreed to host the MRS, and we favor the inclusion of these broader incentives for the MRS along the lines of those provided in S. 839 in the MRS authorizing legislation, as long as this can be accomplished without delaying the MRS.

The industry believes that the MRS should be located at a readily licensable site and, further, the site should be to the extent possible one that would minimize transportation distances from a majority of the Nation's reactors.

DOE has completed its site selection process and is recommending Oak Ridge, TN, as its preferred site. We urge Congress to approve the site recommended by DOE now. However, we further urge that Congress provide for the designation of an alternative site to permit a State or Indian tribe to come forward within some appropriate period of time to offer an acceptable alternative site under this incentives program.

In closing, the industry is extremely concerned over the current state of affairs surrounding implementation of the Nuclear Waste Policy Act. Utilities have collected from our consumers and paid to the Federal Government $2.9 billion. DOE now faces significant opposition to the continued implementation of the act for the sites that have been selected for characterization of the first repository.

Industry is concerned about whether or not DOE will be allowed to live up to its statutory and contractual obligation to take spent fuel by January 31, 1998. It is imperative that concerns regarding the nuclear waste program implementation be resolved and that Congress take positive action to assure that a national high level radioactive waste disposal system becomes a reality.

Besides authorizing and funding the MRS, as I recommended, we also urge Congress to move the program forward by funding the characterization of the potential first repository sites, including provision for exploratory shaft drilling.

We welcome this opportunity to present our views and would be happy to answer any questions.

[The prepared statement of Mr. Berry follows:]

TESTIMONY OF
WILLIAM W. BERRY, CHAIRMAN
VIRGINIA POWER
ON BEHALF OF
EDISON ELECTRIC INSTITUTE
AMERICAN NUCLEAR ENERGY COUNCIL
UTILITY NUCLEAR WASTE MANAGEMENT GROUP
ELECTRIC UTILITY COMPANIES' NUCLEAR TRANSPORTATION GROUP
ATOMIC INDUSTRIAL FORUM
ON THE
MONITORED RETRIEVABLE STORAGE FACILITY
BEFORE THE
COMMITTEE ON ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE
APRIL 29, 1987

My name is William W. Berry. I am Chairman of the Board of Virginia Power. My company owns and operates the Surry Station, a two unit 1576 Mwe nuclear power plant in Surry County, Virginia in operation since 1972 and the North Anna Station, a two unit, 1814 Mwe nuclear power plant in Louisa County, Virginia in operation since 1978. Currently 40% of our customer needs are satisfied by our nuclear stations. Virginia Power holds a contract with DOE, pursuant to the Nuclear Waste Policy Act of 1982 (NWPA), for disposal of our spent fuel. To date, Virginia Power has paid approximately $190 million into the Nuclear Waste Fund. Also, I chair the Edison Electric Institute Policy Committee on Governmental Affairs.

My testimony is on behalf of he Edison Electric Institute, American Nuclear Energy Council, Utility Nuclear Waste Management Group, Electric Utility Companies' Nuclear Transportation Group, and the Atomic Industrial Forum. In the best interests of NWPA implementation, we urge Congress to authorize, fund and not to restrict the use of the Monitored Retrievable Storage (MRS) facility.

The groups I am representing today are made up of (in some instances, among others) the electric utilities with nuclear energy programs who are the sole financial supporters of the DOE activities under the NWPA. The electric companies are responsible to the electricity consumer for the appropriate use of these funds. In addition to paying into the Nuclear Waste Fund, as required by the NWPA, electric utilities are, through participation in these groups, following the NWPA implementation, as well as providing assistance to the Federal Government, where appropriate.

MONITORED RETRIEVABLE STORAGE FACILITY

The nation requires development of a technically sound and publicly acceptable high-level radioactive waste disposal program for commercial use of nuclear energy to continue. In this regard, it is the industry's overriding goal to achieve efficient, effective and fair implementation of the NWPA leading to the successful operation of a national high-level radioactive waste disposal system as close to the NWPA schedule as possible. By authorizing, funding and not restricting the use of the MRS, Congress would be taking a large step towards this end.

Industry Support

The industry supports -- unequivocally -- the need for the MRS. Through its CEO committees and association boards of directors, the industry adopted a policy in support of the MRS:

EEI: March 13, 1986, reaffirmed March 12, 1987; ANEC: December 19, 1986; APPA: March 4, 1987; (Legislative Committee with Board approval in May 1987) NRECA: March 1986, reaffirmed in 1987. It is unfortunate that opponents of the MRS try to exploit the different opinions held by a few individuals within the industry in an attempt to show that industry support for the MRS is lacking. The General Accounting Office (GAO), in its May 1986 Fact Sheet, reported misleading survey results that seemed to show a lack of full industry support for the MRS. These misleading results, which are discussed more fully below, were the the product of a survey questionnaire that simply asked the wrong questions.

MRS Advantages

As an integral part of the high-level radioactive waste disposal system, the MRS will perform functions essential to the disposal of spent fuel. It will provide vitally needed flexibility in the planning, design, construction and operation of the disposal system, thereby lessening the effects of the uncertainties that DOE faces. Furthermore, the NWPA implementation experience thus far has demonstrated that progress is, indeed, a precious commodity. The MRS is an important item that will make progress towards the operation of the disposal system earlier than would be the case with a repository-only system. Having the MRS in the disposal system would help bring the first repository into operation sooner by allowing a more flexible and efficient repository design and licensing process. The nuclear industry supports the development of an MRS as an integral part of the repository program. However, the MRS is not acceptable for long term disposal, which must be accomplished in a deep underground repository. DOE has raised the importance of the MRS by planning to use the facility to live up to its statutory and contractual obligation to accept spent fuel by January 31, 1998. If Congress accepts this NWPA implementation change, then Congress must authorize, fund and not restrict the use of the MRS.
The MRS would be a vital part of the nation's high-level radioactive waste disposal system. It would provide a location for preparing spent fuel for disposal as well as serve as a transportation hub for the movement of spent fuel from reactors to the repository. The MRS would consolidate fuel (if required), package it for disposal, which are functions that must, in any event, be part of the above ground element of a repository system. It would also provide a limited amount of storage. These are important functions necessary for the disposal of spent fuel, however, there are stronger reasons for including an MRS as part of the high-level radioactive waste disposal system: flexibility and progress.

The NWPA implementation is unprecedented in its scope and time period. Given the nature of the NWPA implementation, it is prudent management to provide a disposal system with design and operational flexibility. It is also prudent to provide a method for relatively early progress in disposal system development and operation. The MRS would provide these advantages.

Including the MRS would allow the separation in engineering, design, construction and licensing for the two parts of the current repository design (surface and subsurface facilities). This would allow DOE to concentrate its resources and use them in a more efficient and effective manner. It would be easier for DOE to run these projects if the two large pieces could be separated.

The separation would allow system planning to take place earlier than would be possible with the repository-only system. This would be especially important in the licensing and institutional relationships of the disposal system. This includes transportation planning. With the location of the MRS set, from-reactor transportation planning can begin without having to wait for finalization of the repository location. All parties would have earlier experience in these matters, because the MRS would require activities similar to that for the repository.

The separation would also provide a more flexible operating system. An MRS would provide the disposal system with the ability to more efficiently handle spent fuel as it travels from the reactors to the repository. For example, the from-reactor transportation system can operate independently of the repository loading requirements so there would be no need to coordinate spent fuel operation at over 100 reactors with operations at one or two repositories.

The MRS will have a positive effect on the overall performance of the high-level radioactive waste transportation system. Furthermore, based on world-wide experience over more than three decades and the many analyses that have been made of spent fuel transportation radiological risks, these are so low that any change in the transportation pattern with an MRS in place will not result in a statistically significant change insofar as any particular state or region is concerned. With respect to the other transportation impacts to a state or region resulting from spent fuel transportation to a repository or to the MRS, the DOE's analyses show these to be very small as well. Also, DOE is committed in its Transportation Institutional and Business Plans and in its MRS Proposal to mitigate transportation impacts where feasible. An important advantage of authorizing the MRS is that DOE and the affected states can make early decisions as to the best means to deal with these impacts and how most effectively to utilize existing capabilities of state and federal agencies.

Lastly, including the MRS would also provide needed progress towards the disposal of spent fuel at a date earlier than would be possible with a repository-only system. Development and licensing of the above ground facilities would not be tied to the progress of below ground development. And, of course, DOE now plans to begin receiving and packaging spent fuel before the repository is operational to live up to its statutory and contractual 1998 obligation.

Taking all of these purposes and benefits together, including the MRS in the high-level radioactive waste disposal system makes a great deal of sense and DOE would, without the facility, very likely violate the 1998 obligation.

Foreign Disposal Programs

There has been much recent discussion of the high-level radioactive waste disposal programs in several European countries. It is important to recognize that everyone of these programs, especially in France, West Germany and Sweden, has the disposal of high-level radioactive waste in deep geologic repositories as its ultimate goal. Their schedules differ from ours and the specific activities they will pursue are somewhat different, because of their different regulatory and institutional structures. Nonetheless, the ultimate goal - disposal in deep geologic repositories - is the same.

Most countries appear to be making progress towards ultimate disposal by the use of a central collection, preparation and interim storage facility. France, West Germany and Sweden plan to dispose eventually of their nuclear waste in deep underground geologic repositories. However, each have planned central interim facilities for spent fuel or high-level waste prior to ultimate disposal. In France, spent fuel is placed in water pools at the reprocessing plant site, subsequently reprocessed and the separated high-level waste solidified by glassification into waste packages for disposal at a later date. The same general approach is planned for West Germany except the spent fuel is placed in dry storage casks at a central facility prior to reprocessing. In Sweden, the quantity of spent fuel is limited to their specific nuclear program and it is being placed in a central water pool facility for an extended period before being packaged for placement in a geologic repository without reprocessing. The US can also begin to make progress towards disposal if Congress authorizes, funds and does not restrict the use of the MRS facility.

DOE's MRS Proposal

DOE's March 1987 Proposal to Congress for the MRS is generally acceptable to us and we urge Congress to authorize and fund the facility. We recommend however, that Congress not restrict the start-up of the MRS, as DOE suggests, by linking it to the receipt of a first repository construction authorization.

The Proposal also recommends that Congress authorize DOE to provide substantial benefits to the MRS host State and local communities. These include financial assistance payments, payments-equal-to taxes, mitigation assistance payments for effects on property value and local economic development, and use of local contractors and suppliers to the maximum extent possible, including providing training programs to help develop local capabilities and selecting contractors that would bring diversification to the area. In addition, if Congress approves DOE's recommendation for siting the MRS on the site of the former Clinch River Breeder Reactor, DOE proposes to release other DOE land to the local community in compensation for removing the CRBR site for consideration for industrial development.

These provisions are appropriate steps towards the needed incentives for assisting NWPA implementation. The recently proposed S. 839, Nuclear Waste Policy Act Amendments Act of 1987, would offer much greater incentives to a State or Indian Tribe for agreeing to host the MRS. Such additional incentives appear to be reasonable and it may be appropriate to provide an expanded incentives package for the MRS facility. However, it is most important that developing this broader MRS incentives program not be permitted to be used as a justification, or an additional opportunity for, further delay in NWPA implementation, including MRS authorization. We favor inclusion of broader incentives for the MRS, along the lines of those proposed in S.839, in the MRS authorizing legislation, as long as this can be accomplished without delaying MRS autorization.

The industry believes that the MRS should be located on a readily licenseable site. And further, the site should, to the extent possible given other siting considerations, minimize the transportation distances from the majority of the Nation's reactors. DOE's preferred site in Oak Ridge, Tennessee meets these criteria. However, there are a number of such sites within a reasonable distance of the centroid that would be acceptable. We urge Congress to approve the site recommended by DOE now. However, we further urge that Congress provide for designation of an alternative site to permit a State or Indian Tribe to come forward, within an appropriate period of time, to offer an acceptable site under the incentives program.

The MRS Proposal describes a facility and technology for packaging spent fuel in high quality, repository ready containers. We believe that DOE should develop a flexible MRS approach. Future developments in overall disposal system design may alter the functions performed at the MRS. To make maximum use of the flexibility provided by the MRS, DOE needs to optimize the overall disposal system, including the MRS.

One aspect of DOE's MRS strategy that we cannot agree with is the linkage between MRS operation and receipt of the NRC construction authorization for the first repository. DOE suggests that such linkage is needed to allay concerns that the MRS facility could become a substitute for a permanent repository. The linkage concept is inconsistent with the purpose of the MRS as described in the Draft Mission Plan Amendment. The effect of the proposed linkage would be to raise a significant question whether DOE will be able to meet its statutory and contractual commitment to begin to accept spent fuel in January 1998. The Draft Amendment shows that the construction authorization is scheduled for the first quarter of 1998. That schedule is an optimistic one and assumes a relatively brief licensing process and no litigation-imposed delays. If the construction authorization process does not meet DOE's thirty-six month target or if other contingencies should occur, MRS operation would be delayed and the January 1998 commitment will be violated.

HIGH-LEVEL RADIOACTIVE WASTE DISPOSAL

The industry submitted a statement for the record of this Committee's hearings on January 29, February 4 and 5, 1987. As indicated therein, the industry is extremely concerned over the current state of affairs surrounding the NWPA implementation. Electric utilities with nuclear energy programs have collected from electricity consumers and paid $ 2.9 billion into the Nuclear Waste Fund. Now DOE faces significant opposition to the continuation of NWPA implementation from the States, and affected Indian Tribes, that have sites selected for characterization for the first repository.

Congressional Actions Desired

For DOE to take the necessary steps to implement the NWPA during FY 1988, we continue to ask Congress, in addition to authorizing, funding, and not restricting the use of the MRS, to appropriate sufficient funds from the Nuclear Waste Fund, monies provided by electric utilities and their consumers, to proceed expeditiously with site characterization (including drilling exploratory shafts). Also, we urge Congress to provide equitable payments to the Nuclear Waste Fund for defense waste disposal. In addition, we continue to support the need for broader incentives to the States, Indian Tribes and local communities that will host high-level radioactive waste disposal facilities, including, as indicated above, the MRS facility.

Draft Mission Plan Amendment

The January 28, 1987 Draft Mission Plan Amendment lays out a new program strategy that shifts the operational date of the first repository from 1998 to 2003, that indicates DOE will live up to its contractual obligation with electric utilities to take spent fuel in 1998 by use of the MRS, that reprograms the second repository effort and pledges better cooperation with affected parties.

Congress passed the Nuclear Waste Policy Act of 1982 in December 1982 and President Reagan signed it into law on January 7, 1983. Even though most of the statutory schedule dates have not been met, several very important milestones have been reached. Most importantly, the three first repository sites for characterization were named and approved by the President. It is unfortunate that the recent impasse over the recommended second repository reprogramming is threatening the progress achieved to this point on the first repository and MRS. One of the challenges to the present program is the perception by some that a delay in implementing the NWPA is acceptable and even desirable if it results in a better repository system. The program may continue to be paralyzed by the quest for a better solution, even though the direction being pursued is entirely adequate for the safe disposal of nuclear waste.

Electric Utility Storage Programs

The industry is concerned about whether or not DOE will be allowed, by opponents to NWPA implementation, to live up to its statutory and contractual obligation to take spent fuel by January 31, 1998 and what recourse might be available to utilities in the event that it is not. In the interim period, which is beginning to look longer than understood when the NWPA was enacted, the utility industry will be faced with providing spent fuel storage at reactor sites. A number of utilities have developed, or are developing, at reactor storage alternatives against the day that the spent fuel storage capacity originally built into the reactor plants proves to be insufficient. For example, Virginia Power has completed, licensed and is demonstrating a dry cask storage installation at the Surry Station; Carolina Power and Light Company has a licensed dry storage concept using air cooled vaults. Others continue to expand pool storage capacity by installing higher capacity storage racks and a few are involved in developing rod consolidation technology. Electric utilities recognize that they are responsible for at reactor storage of spent fuel until DOE takes responsibility in 1998. However, if any utility's spent fuel is not taken from the reactor site by DOE under the original NWPA schedule, it will have to expend additional sums to continue at reactor storage. Those utilities could very well seek recovery of those expenditures from the Federal Government due to its failure, for whatever reason, to live up to its contractual obligation.

It would be inappropriate for the high-level radioactive waste disposal system to include at reactor storage as more than a temporary expedient until the MRS is available. At reactor spent fuel storage and related activities could not substitute for the MRS. As discussed above, the MRS is much more than a storage facility. Essential functions of preparing the waste for permanent disposal by carefully placing it in extra high quality repository ready containers that will effectively contain the waste for a long time will be performed at the MRS. Having the MRS near the majority of the nuclear energy plants permits an efficient transportation system and the use of unit trains for the long haul from the MRS to the repository. Flexibility for the disposal program and early progress that is not on the critical path of selecting the repository site are the principal advantages of the MRS. Furthermore, we question whether electric utilities that operate nuclear energy plants should be required to perform functions as part of the high-level radioactive waste disposal system. There are tremendous technical, operational, regulatory and institutional barriers to having electric utilities perform these functions. Also, it only makes sense to concentrate these activities at a single location rather than at 72 locations across the country. And, for the reasons stated above, that location should be the MRS.

GENERAL ACCOUNTING OFFICE MRS SURVEY

Returning to the question of industry support for the MRS and the GAO survey. A close examination of the GAO questionnaire and summary report reveals an unusual and questionable approach used by the GAO. GAO distributed its survey several months before the DOE draft MRS documents were available for review within the industry. In the survey's introduction, GAO provided a 57 word comparison of the MRS and repository to give the responder some idea of the concept. In doing so, the GAO erred in its description of the MRS, making it appear to provide a simple storage function at an expensive facility. GAO asked two basic types of questions: (1) the utility's plans for storage of its spent fuel at reactor sites, and (2) the utility's view on the need for an off-site storage facility before 1998. No discussion on relative advantages and disadvantages of the MRS was provided. The GAO questions missed the basic points of the MRS facility and the survey results were not surprising - only misleading. All questions, unfortunately, presupposed that the repository would be available by 1998. As the previous discussion points out, one purpose of the MRS would be to help bring about progress that would lead to an operational repository as close to the 1998 date as possible. Since the GAO survey questions assumed that this occurs even without the MRS, then the responses cannot be taken as a proper measure of the industry position. Consequently, the GAO survey and its conclusions are invalid. The electric utility industry fully supports the MRS facility and the GAO survey results do not reflect the utility industry position, because of the faulty approach taken by GAO.

CONCLUSION

The NWPA was a product of Congress's determination that disposal of high-level radioactive waste is essential in order to preserve this nation's nuclear energy option. It is imperative that concerns regarding NWPA implementation be addressed and resolved and Congress take positive action this year to assure that a national high-level radioactive waste disposal system becomes a reality:

- authorize, fund and not restrict the use of the MRS and
- fund first repository site characterization, including exploratory shaft drilling.

Thank you for the opportunity to present our views on the Monitored Retrievable Storage facility. We would be pleased to answer your questions.

* * * * * *

The **Chairman**. Thank you very much, Mr. Berry, for your testimony, which is succinct, to the point, understandable, and I agree with it all, which is the most important part.

Do you know why GAO is saying that the utilities do not support the MRS and that the MRS is not needed?

Mr. **Berry**. GAO sent out a questionnaire. They sent it out before the MRS draft was submitted by DOE. So at that time the utilities who received the questionnaire did not know what DOE was proposing.

The questionnaire—the questions asked were, in my judgment, faulty and consequently they got faulty answers. And second, there was a fear then, as there is a fear now, that the MRS, as we have heard today, might be the substitute for a permanent repository, rather than a part of the total system, which is what DOE ended up proposing.

The questions asked things like, if DOE cannot take your fuel in 1998, would you be willing to keep it at your reactor site? Willingness does not have anything to do with it. If DOE does not take our fuel in 1998, it is going to stay at our reactor site.

So it was that sort of faulty question that I think produced a misleading result.

The **Chairman**. Well, you are the representative from EEI, and the EEI, I know—and I ask you—does speak for the utility industry on this issue, do they not?

Mr. **Berry**. I am speaking for more than that. Let me check my list here. I am representing the Edison Electric Institute, which represents the investor-owned utilities, the American Nuclear Energy Council, which represents a broad spectrum of the nuclear industry beyond just the utilities, the Utility Nuclear Waste Management Group, which includes both investor-owned and publicly owned utilities, the Utility Nuclear Transportation Group, which also includes nonprivately owned companies, and also the Atomic Industrial Forum, which again represents a broad section.

The **Chairman**. That is everybody so far as I know.

Mr. **Berry**. And all of these boards have met and passed resolutions supporting the MRS and then reaffirmed them. The litany of all that approval is included in my testimony.

The **Chairman**. Well, I am glad to get that clearly on the record. I take it you believe the MRS will not increase the cost of nuclear waste management?

Mr. **Berry**. I certainly do not. This is particularly true for Virginia Power. We will be putting fuel in dry casks at our Surry station, about three per year, and they are costing us, with the current cost of the mark, and we get them from Germany, it is about a million dollars a crack.

So each year that this is delayed is about $3 million just for us at one reactor site.

The **Chairman**. I also take it, since you support strongly the repository, that you do not believe the MRS will detract from the effort to site a repository?

Mr. **Berry**. I think in fact it can have a favorable impact on getting a deep geologic repository.

The **Chairman**. I want to be clear and repeat something that I have been repeating since the Nuclear Waste Policy Act passed, and that is that this is the law that requires both. The DOE, I think, before Mr. Rusche came seemed to think that MRS was not mandatory, that it was a possibility.

It was always our contention, and I think the law explicitly says, that MRS is required. We know a repository is required. They are both required under the law, both of them, dual track, and they are both supported by DOE and I think supported by this committee. I know they are supported by me.

So we do not—there is no plan to increase the size of the MRS. I repeat, no plan to substitute the MRS for the repository. And if anybody thinks you could amend this law to do away with the repository in favor of the MRS, or do away with the MRS in favor of the repository, I think you are not accurately reading politics.

And the law I think is clear. So Mr. Berry, I am very pleased that you have made so clearly on the record the position of the industry, a united industry which recognizes it is not only in the interests of utilities and ratepayers, but that it is a united industry and a united group that so state.

So thank you very much.

Next we will hear from Peter Bradford, President of NARUC.

STATEMENT OF PETER BRADFORD, PRESIDENT, NATIONAL ASSOCIATION OF REGULATORY UTILITY COMMISSIONERS

Mr. **Bradford**. Senator Johnston, it is a pleasure to appear before this Committee again. NARUC deeply appreciates this latest opportunity to make its views known to the U.S. Senate.

I will summarize my overall testimony, with the understanding that it will be printed in full.

The problems facing the national nuclear waste program are extensive and formidable, and only the Congress is empowered to implement solutions of the nature and depth that will restore direction to a program that is now in significant disarray.

We commend you and Senator McClure for being willing to begin to review and rethink the directions of the nuclear waste program to date. There is little reason to think that the ultimate repository can be licensed through a result-oriented or preemptive federal process or through the elimination of judicial review.

That approach has been tried to some degree with the commercial nuclear reactors and it has, together with other factors, brought the nuclear power industry from public favor to public alarm in two decades.

It will not help to assert that the technical problems in the waste disposal program are not difficult and that the waste problem is fundamentally political. This formulation, even if true, somehow suggests that politics is less important or less worthy to be taken seriously than technology.

This proposition is usually put forward by those who go on to assert that the public fears are irrational and not worthy of serious regard. Unfortunately, all the committees on energy awareness that the industry can assemble cannot buy another public, and the one that we have does not take kindly to having its fears dismissed as irrational.

This is particularly true when many voices have been raised over the past ability or willingness of the DOE to work effectively with the states, Indian tribes, or citizen groups. The U.S. General Accounting Office and the Congress are among those voices.

Nor is public confidence enhanced when the search for the site of the second repository is cancelled or postponed in an attempt, unsuccessful at that, to influence the outcome of a few 1986 elections.

NARUC is under no illusion that the repository development and licensing process is going to go smoothly. However, we are inclined to believe that it is not going to proceed at all unless fundamental reassessments are made by the Congress.

The MRS is just one among many major issues that the program now faces, and I would like to take this opportunity to put it in the context in which NARUC sees it. Basically, that context is that other broader problems have already made interim storage inevitable.

As to the MRS itself, the first specific—which is the first specific that I want to deal with, Congress is going to have to decide whether it has sufficient information on which to base its decision on the advisability of the MRS.

The **Chairman**. Can I interrupt you at that point, Mr. Bradford. That is a decision which Congress has made and made back at the time of the Nuclear Waste Policy Act. I was the author of the Nuclear Waste Policy Act. I was the author of the legislation in the Congress before that.

We passed legislation in the Senate, the Nuclear Waste Policy Act of 1980, I think it was. It did not make it through the House. And it provided only for MRS, no deep geological.

And then we came back with the grand compromise of the Nuclear Waste Policy Act of 1982 with the dual track. And it was not an if. We did not leave it up to the Department of Energy as to whether they should or should not. We said bring us a design sufficiently detailed for us to go to contract with.

I think we said within a year, which was much too ambitious a job. But we made the decision at that point.

Now, there must be some ambiguity that I do not see in the law, but there is no ambiguity in the history of the act and what was said on the act. It was clearly a dual track. Yes, we decided we wanted an MRS. And yes, we decided we wanted a repository.

And it was not like we were going to have some studies and decide. I mean, it was clearly not the scheme. The scheme was an MRS.

So I just want to make that clear, because I used to have that argument with the Department of Energy before Ben Rusche came. That was never the intent.

Mr. **Bradford**. Senator, I did not mean to suggest that you had not decided on the overall advisability of an MRS. But as I understand the law, it does contemplate a further congressional authorization before one could proceed to the construction of a particular MRS at a particular site. And what I meant to allude to here was whether you now have sufficient information to make that decision and to go forward.

Initially, the MRS was proposed as a backup to the repositories as needed. At least that is our understanding. By 1985, the DOE had developed it into an integral portion of the disposal program.

With the recently announced slips in schedule, some MRS now becomes critical to the DOE's efforts to meet its responsibility for 1998 fuel acceptance. This must be weighed in light of a troubled and thus far incomplete MRS site selection process and the recent discussion by some in the Congress that there should be more than one MRS.

And finally, there is the question of whether DOE can carry the burden of the development process of an MRS without losing ground on the ultimate goal, the final repository program.

S. 839 proposes to reduce, through cash payments to volunteers, some of the enormous resistance to acceptance of a long term disposal facility or an MRS. Monetary rewards may be one of the ways to convince a locale to overcome the "not in my back yard" syndrome.

However, affected citizens must find the process and its managers to be credible. No amount of money can overcome public fears over a perceived flawed repository resulting from a perceived flawed process. Only a technologically sound, well run program and a thorough and fair siting process can do that.

NARUC's third concern is with the defense waste disposal payments, which are not currently dealt with in S. 839 or in other pending Congressional legislation. For many months, NARUC has urged the DOE to formulate appropriate costs to be assessed for defense waste disposal and to be advocates for the initiation of such payments.

Fundamental to this issue is how much defense waste will be put in the repository, including the fate of the contents of Hanford's single wall waste tanks. No agreement over the funding formula or the amount of waste to be disposed of has been achieved. No payments have occurred.

The DOE treats this as an in-house matter, while electric ratepayers continue to subsidize defense programs. Billions of dollars are involved, and some in the Congress have stated their reluctance to make the payments. And by that we have in mind the recent report of the House Armed Services Committee, which stated that:

> The Committee is also concerned, if the fees are to be paid, that vital programs will have to be sacrificed for repository use that may never materialize."

Such views do not help one lend credibility to the waste program, and Congressional action to resolve this problem is a must from NARUC's standpoint.

Program oversight is another concern that we commend to your attention at this time. In the interest of contributing to the best possible disposal program, the NARUC has recommended an ongoing assessment of the DOE management and its organizational structure.

It is not unreasonable, in the face of a $20 to $40 billion project, to identify any significant management improvement potential. Based on the NARUC's extensive experience with such matters in the utility field, audits and reviews are readily achievable.

We have also recommended attention to the concerns voiced by the General Accounting Office that, in their overall responsibilities and specifically to the waste program, the DOE's auditing of contractors badly needs improvement. The Congress must decide what improvements must be made in the conduct of this program, whether the DOE's delivery is adequate, whether the expenditure of funds is prudent and well controlled, and whether the DOE is carrying out the Congressional intent of administering the program.

In conclusion, let me touch a little further on the role of Congress in the program from our perspective. In addition to the overall goals, the Congress provided through the Act reasonably specific directions to the waste program. It set a schedule of major programmatic milestones. It required studies and, through the fee, an estimate of an overall budget.

Nevertheless, substantial numbers of deadlines have not been met. 1998 is now announced as all but impossible, attributed in part by the DOE to the Congress' refusal to release all of the requested funds last year. Those announced budget cuts may well be in order.

They should, however, merely precede affirmative Congressional programmatic orders. To date, ratepayers have sent $3 billion, including interest, to Washington. In return, the entire program has been extended to 2003, five years longer than the 1998 mandate of four years ago. Thus the net result of the last four years is the loss of one.

The public utility regulators feel that the immense sums generated by the one mill per kilowatt-hour fee should be enough to safely and permanently store the radioactive wastes now lodged in the respective jurisdictions. But in fact, we have no assurance that more will not be sought.

There is no guarantee that any fuel will move anywhere eleven years from now. Increasingly—and we have to carry this message—local citizens and governments must realize that spent reactor fuel is likely to be stored among us for many years.

We face additional costs and problems at home, where that spent fuel has been and will continue to be for a long time, in de factor MRS facilities that, by the way, were not designed for storage for anywhere near the time that they obviously will be used.

This in-State burden, the program difficulties, the open-ended cost arrangement, the debated final goals, the 5-year delay in the program, must give utility regulators profound pause.

Few expected implementation of this difficult disposal effort to fall easily into place. The failure of past high level disposal programs, the challenges to the credibility of the agency and other programs, its record in controlling environmental contamination, and its defense facilities and its linkage to the promotion of commercial nuclear power add to the problems of credibility facing DOE.

The NRC is having its own credibility problems, which undercut its ability to offset any perceived DOE bias. Our message to the Congress therefore is both obvious and urgent. As the creators of a delicately balanced piece of legislation designed to effectively handle the long term disposal of high level nuclear wastes, the piece of legislation now in significant and substantial disarray, only you can step into the breach.

Only the Congress can right the course of this program and only the Congress can determine whether its intent is being followed. Only the Congress can assure that a safe and cost-effective product results.

Years of debate and chaos and moneys thrown into a bottomless pit would serve neither the interests of the program or the ratepayers. And at some point, the taxpayers would wind up bearing the fiscal burden.

We stand ready to help in any way that we can with this reassessment of the nuclear waste management program.

Thank you very much.

[The prepared statement of Mr. Bradford follows:]

UNITED STATES SENATE
COMMITTEE ON ENERGY AND NATURAL RESOURCES
SUBCOMMITTEE ON ENERGY RESEARCH AND DEVELOPMENT

TESTIMONY OF THE

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ON THE

CIVILIAN RADIOACTIVE WASTE MANAGEMENT PROGRAM

APRIL 29, 1987

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Chairperson Johnston and Members of the Committee:
My name is Peter Bradford. I am President of the National Association of Regulatory Commissioners (NARUC). I am chairman of the Maine Public Utilities Commission and former Commissioner of the U.S. Nuclear Regulatory Commission. Commissioner Edwyna Anderson of Michigan, the chair of the NARUC's Electricity Committee regrets her inability to be here today. She has, as you know, led the NARUC effort on nuclear waste with determination and effectiveness, and I am glad to appear on her behalf as well as NARUC's.

The National Association of Regulatory Utility Commissioners (NARUC) deeply appreciates this latest opportunity to make its views known to the United States Senate. The problems facing the national nuclear waste program are extensive and formidable; only the Congress is empowered to implement solutions of the nature and depth that will restore direction to a program now in significant disarray. We, on behalf of electric utility ratepayers, share the concern of the Congress and others for thorough and fair licensing process and a successful, safe disposal program. In addition, our unique consumer protection role engenders our deep concern over a cost-effective, successful and safe disposal program.

There is little reason to think that the repository can be licensed through a result-oriented and preemptive federal process. That approach has been tried with the commercial nuclear reactors, and it has - together with other factors - brought the nuclear power industry to its knees. As long as we remain a democracy, it is the public that will get to choose its energy sources - not vice versa.

It does no good to assert that the technical problems in the waste disposal program are not difficult, and that the waste problem is fundamentally political. This formulation somehow sugests that politics is less important or less worthy to be taken seriously than techology. It is a proposition usually put forward by those who go on to assert that the public fears are irrational and not worthy of serious regard.

Unfortunately, the public does not take kindly to having its fears dismissed as irrational. This is particularly true when many voices have been raised over the ability or willingness of the Department of Energy (DOE) to work effectively with states, Indian Tribes and citizens. The U.S. General Accounting Office and the Congress are among them. Despite calls from the Governor of Washington and the NARUC to initiate mediation, there is no agreement from the DOE.

Nor is public confidence enhanced when the search for the site of the second repository is canceled in an attempt - unsuccessful at that - to influence the outcome of a few 1986 elections.

We are under no illusion that the repository development and licensing process is going to go smoothly. However, we are inclined to believe that it is not going to proceed at all unless fundamental reassessments are made by the Congress.

The Monitored Retrievable Storage (MRS) Facility

The Congress must decide whether it has sufficient information on which to base its decision on the advisability of an MRS.

Initially, the MRS was proposed as a backup to the repositories, if needed. By 1985, the DOE had developed it into an integral portion of the disposal program. With the recently announced slips in schedule, the MRS now becomes critical to the DOE's efforts to meet its responsibility for 1998 fuel acceptance. The support document by the Department of Energy (DOE) appears to lack objectivity and apparently is designed to serve the DOE's goal of constructing an MRS.

All this must be weighed in light of a troubled, incomplete MRS site selection process and the recent discussion by some in the Congress that there should be more than one MRS.

Finally, there is the question of whether the DOE can carry the burden of the development process of an MRS without losing ground on the ultimate goal, the final repository program.

The Johnston-McClure Bill

S.839 proposes to break down through cash payments to volunteers some of the enormous resistance to acceptance of a disposal facility. Social scientists find that monetary rewards are one of the ways to convince a locale to overcome the "not-in-my-backyard" syndrome. They also assert, however, that affected citizens must find the process and its managers credible, to bolster confidence that the facility can contain its radioactivity. No amount of money can overcome public fears over a perceived flawed repository resulting from a perceived flawed process. Only a technologically sound, well run program can do that.

Defense Waste Disposal Payments

For many months the NARUC has urged the DOE to formulate appropriate costs to be assessed for defense waste disposal and to be advocates for the initiation of such payments. Fundamental to this issue is how much defense waste will be put in the repository, including the fate of the contents of Hanford's single walled waste tanks. No agreements over the funding formula or the amount of waste to be disposed have been achieved. No payments have occurred. The DOE treats this as an in-house matter while electric ratepayers continue to subsidize the national defense program. Billions of dollars are involved. Some in the Congress have stated their reluctance to make payments:

> "Administrators of the waste repository program within the Department of Energy appear to contemplate the payment of a huge up-from payment from the Department of Energy defense program followed by annual fees . . . . . "the political hurdles contained in the NWPA may never be crossed. The (Armed Services) Committee is also concerned that, if the fees are to be paid, vital programs will have to be sacrificed for repository use that may never materialize." (National Defense Authorization Act for FY'87, Report of the U.S. House Committee on Armed Services)

Such views neither distinguish nor lend credibility to the waste program or to the Congress. Congressional action to resolve this problem is a must.

Program Oversight

In the interest of contributing to the best possible disposal program, the NARUC has recommended ongoing assessment of the DOE management and its organizational structure. It is not unreasonable in the face of a $20 to 40 billion project to identify any significant management improvement potential. Based on the NARUC's extensive experience with such matters in the utility field, audits and reviews are readily achievable. We also have recommended attention to the concerns voiced by the U.S. General Accounting Office that, in their overall responsibilities and specific to the waste program, the DOE's auditing of contractors needs improvement. The Congress must decide what improvements must be made in the conduct of this program, whether the DOE's delivery is adequate, whether the expenditure of funds is prudent and well controlled and whether the DOE is carrying out Congressional intent in administering this program.

Program Goals

As you are well aware, the direction and goals of the program are under siege. The Mission Plan did not survive its first anniversary. As to overall goals, the major questions are now disturbingly fundamental, despite passage of the Nuclear Waste Policy Act. How and by whom will the site of the first repository be picked? Are there two repository programs? If so, what is the near-term goal of the second-round program? If there is to be only one repository, which sites are under consideration? Are there three, five or nine? If only one repository is to be built, what is to be used as an alternative or backup? How do we avoid another Lyons, Kansas debacle in which no backup site was available?

Congress and The Program

In addition to the overall goals, the Congress provided through the Act reasonably specific directions to the waste program. It set a schedule and major programmatic milestones. It required studies and, through the fee, the estimate of an overall budget. Nevertheless, substantial numbers of deadlines have not been met. 1998 is announced as all but impossible, attributed in part by the DOE to the Congress's refusal to release all the requested funds last year. Those announced budget cuts may well be in order. They should, however, merely precede affirmative Congressional programmatic orders. Prohibitions on drilling and a warning that too many lawsuits are being filed do not constitute resolution of program conflicts and a reorienting of direction. The Congress must be uniformly specific as to its intent throughout the development of this program.

The NARUC also is keenly aware of the matter of public acceptance. We have noted an increasing hardening of attitudes on all sides. It is perhaps understatement to note there was no overall improvement in state-federal relations following the DOE's May 28th, 1986 announcement that it was discontinuing a search for a second repository site. Some time ago we requested Congressional attention to the intergovernmental and public problem. The report released by the U.S. General Accounting Office of its audit of state and federal interaction may help heal the current schism. But we believe more substantial improvements must be made. For it may well be that a federal effort that does not generate substantial credibility and some acceptance, however reluctant or begrudging, will never succeed in establishing a disposal facility. Should these factors result in a complete breakdown in progress, ratepayers could continue to pay dearly for busy work that leads nowhere.

To date, ratepayers have sent $3 billion, including interest, to Washington. In return the entire program has been extended to 2003, five years longer than the 1998 mandate of four years ago.

Public utility regulators feel that the immense sums generated by the 1 mill per kilowatt-hour fee should be enough to safely and permanently store the radioactive waste now lodged in their respective jurisdictions, but we have no assurance that more will not be sought. There is no guarantee any fuel will move 11 years from now. Increasingly, (and we are committed to carrying this message) local citizens and governments must realize that spent reactor fuel is now stored among us. We face additional costs and problems at home where that spent fuel has been and will continue to be for a long time to come - in de facto MRS facilities that, by the way, were not designed for storage for anywhere near the time they obviously will be utilized. This in-state burden, the program difficulties, the opened-ended cost arrangement, the debated final goals and the five-year delay in the program must give utility regulators profound pause.

Few expected implementation of this difficult disposal effort to fall easily into place. The failure of past high-level disposal programs, the challenges to the credibility of the agency in other programs, its record in controlling environmental contamination at its defense facilities and its linkage to promotion of commercial nuclear power add to the problems of credibility facing the DOE.

On the other hand, the waste is here. There is little choice. The NARUC has pledged its best efforts to contribute to a safe solution to the problems that presently plague a project that all citizens inevitably must support. Our national safety depends on it and the costs of it fall to most of us.

Summary

In our commitment, we recognize there is a legitimate cost for disposal that ratepayers must bear. However, as we have advised the Congress many times, considering both equity and ability to pay, there is a limit to the financial resources of ratepayers for high-level nuclear waste disposal. Wasted money and resources have no place in the process.

The message to the Congress is both obvious and urgent. As the creators of a delicately balanced piece of legislation designed to effectively handle the long-term disposal of high-level nuclear waste - a piece of legislation now in a significant and substantial state of disarray - only the Congress can step into the breach. Only the Congress can right the course of this program. Only the Congress can determine whether its intent is being followed. Only the Congress can ensure that a safe, cost-effective product results. Years of debate and chaos, of monies thrown into a bottomless pit, serve neither the interests of the program nor the ratepayers (and at some point the taxpayers) who bear the fiscal burden.

We must all share in the responsibility of seeing to timely completion this essential program. The NARUC is committed to assist in finding the proper solutions. It is the Congress who must take the lead.

April 29, 1987

Subcommittee on Nuclear Waste Disposal,
National Association of Regulatory
Commissioners

Edwyna G. Anderson, Subcommittee
Chairperson,
Commissioner, Michigan Public Service
Commission

Peter A. Bradford, Chairperson
Maine Public Utilities Commission

Robert W. Bratton, Commissioner
Washington Utilities & Transportation
Commission

Anne F. Mead, Chairperson
New York Public Service Commission

Frederick J. Schmidt, Commissioner
Public Service Commission of Nevada

Michael M. Wilson, Commissioner
Florida Public Service Commission

Ronald C. Callen, Subcommittee Staff
Coordinator,
Staff, Michigan Public Service
Commission

The CHAIRMAN. Thank you very much, Mr. Bradford.

Mr. Bradford, we have heard it suggested that we ought to declare a moratorium on the program, that we ought to appoint something like a Tower Commission. I asked the Governor of Nevada what he meant by that, with the lawyers and politicians on it. He said· Well, good lawyers, good politicians, dispassionate, fair, and all of that.

I said: Do you not really think to resolve these questions it would be better to have scientists like the National Academy of Sciences or the Nuclear Regulatory Commission?

Now I ask you, first, should we have a moratorium, and who should study these questions of safety and design and that sort of thing to determine the appropriateness of the site?

Mr. BRADFORD. I will have to speak for myself rather than for NARUC, because NARUC does not have a formulated position in response to that question. But my own view is that enough has gone wrong in the nuclear waste program that an overall assessment by a lessons learning type of commission—I would not myself point to the Tower Commission; I would point more to the Rogers Commission on the Challenger or to the Kemeny Commission on Three Mile Island—would be a worthwhile undertaking.

Both of those, of course, had a heavy scientific component, both to the Commission membership and to the staff. And both of them produced useful reports, from which a great deal was learned.

The difficulty, or at least one of the major difficulties, in the waste program at this point is the fundamental loss of credibility. We can debate the history of the program in terms of who's responsible for that and what has caused it.

That debate seems to me to be less constructive than a review of what kind of steps might restore some measure of credibility to the process by which we get the fuel rods out of the reactors and into whatever their long term storage or disposal is going to be.

It does not seem to me that DOE has within itself the ability to convey that kind of credibility. Intend no insult to Ben Rusche, who I have known and liked for many years, or to Secretary Herrington.

But as a State that has been considered among the potential recipients, at least for the second round of site review, I could tell you that there is nothing the Department of Energy standing alone can do that would make its decision to locate a repository and to construct one a politically acceptable one in Maine.

They cannot do it in a way that the Governor——

The CHAIRMAN. And the National Academy of Sciences and the Kemeny Commission and the Rogers Commission and all those commissions combined could not make it acceptable either?

Mr. BRADFORD. I am not at all sure in Maine that they could.

The CHAIRMAN. If you are not at all sure, let me tell you that they could not.

Mr. BRADFORD. But I think that something along those lines, and a much more extensive reliance on a mediation process, is what has got to be tried. The assumption that somehow the Federal Government can proceed with its head lowered and its shoulders squared, without some such broader overview, some acknowledgment of some of the past mistakes, some effort to learn from them, seems to me——

The **Chairman**. What are the mistakes in your view?

Mr. **Bradford**. The most significant one that I can point to just off the top of my head has been the handling of the second site program. As I say, it would not have been possible, I think, to have had Maine welcoming nuclear wastes.

The **Chairman**. I quite agree with that. On the second site, the Department of Energy has now turned around on that.

And if we appointed a commission and it said, yes, that was a mistake, what more could they do then than what they have already done, which is get it back on line? The reason I ask about what mistakes is because we have had the National Academy of Sciences and the Nuclear Regulatory Commission here, and they have pointed out some procedural things that were not done all that well.

But they said that in their view there was no reason that they knew of that characterization at the three sites or three repository sites should not proceed; that these technical objections and other objections that had been made by the candidate sites can be resolved only by characterization.

I mean, the question of the migration rate of water and the seismic activity and the damage done or to be done by nuclear blasts in the area can only be done by characterization.

Now, do you disagree with the National Academy of Sciences?

Mr. **Bradford**. No, nor did I say that we should stop characterization. I do not count myself among those who feel that the problems of long term disposal of nuclear wastes are insoluble. In fact, to me they are not even comparable in magnitude to the problems of reactor safety.

That is not to say that they are not serious. But my own gut feeling is that, given a choice, if I were inclined to worry seriously about difficulties of living within ten miles of a reactor or ten miles of the repository, I would live within ten miles of the repository. The comparable risks are favorable.

The **Chairman**. Not only favorable, but there is no danger of living ten miles from a repository, is there?

Mr. **Bradford**. Well, I guess I would not say none. But I would say that the risks——

The **Chairman**. To use a phrase someone has used here, vanishingly small, would you not say?

Mr. **Bradford**. I would say that if the entire licensing process and the entire construction process had been as they should be, that the risk would be vanishingly small, yes. But that assumes a great deal. We are not there yet.

The point, though, that I am trying to make is that to me the political issue, the credibility issue, is one that is separate from my own personal feeling about the technical merits.

Even though I personally feel that it can be done, I have to recognize as a public official in Maine that somewhere between 85 and 90 percent of the public there does not feel that, if it happened in Maine, it would be done.

The **Chairman**. I quite agree with you. There is a constant conflict on the issue of credibility. Because we want to make it credible, then we provide for more bells and whistles and more redundancies, which I think is good. But that in turn upsets the public, because they think, my gosh, if you have got to have it 2,000 feet underground and you have got to have 90 feet of concrete and all of these guards and you are going to pay $100 million a year, it must be very, very bad and it must be very, very dangerous.

So everything we do on the one hand to reassure continues to frighten all the more. And that does not mean that we do not want to get into the business of reassurance, because we do.

But it does not mean, at the same time, that it is going to solve the problem.

Mr. Bradford. I do not think that the public's concern, at least the part of it that can be dealt with at all, comes so much from the imposition of the technical safety requirements as it does from concerns such as the waste program being in an agency that is strongly committed, for example, to the reactor program as well, or that the licensing agency is perceived as having a very strong bias in favor of both the reactors and the long term licensing of waste facility.

I am sure that what you say is true and that there will always be an element of concern that just cannot be dealt with. But there are aspects of the way we have set the program up now that seem to me to exacerbate the public concerns to a needless degree.

All that we can do, I think, is to deal with those, deal with the things that we can change, and then we are just going to have to make do with the residue of substantial public opposition that there is not going to be any way around.

Right now we have several elements built into the program that are making things worse.

The Chairman. Thank you very much, Mr. Bradford. It is always a pleasure to have you, and I am sorry to keep all of these witnesses so late here.

But finally, last but not least, is our friend Brooks Yeager from the Sierra Club.

STATEMENT OF BROOKS B. YEAGER, WASHINGTON REPRESENTATIVE, SIERRA CLUB

Mr. Yeager. Thanks, Mr. Chairman. I will try to be even briefer than I was going to try to be about 20 minutes ago.

I would just like to say, about the Sierra Club, you know us. We are a national conservation organization, but we have members not only in the States that have been targeted for high level waste repository or an MRS, but also members in all the States that Mr. Bradford talked about, where waste is temporarily stored.

Over a long period of time, we have evolved a national policy concerning high level wastes, and basically that policy agrees that the Federal Government should have responsibility for the final disposal of both commercial and defense nuclear wastes, and that geologic disposal offers the most promising technical option for isolating this material from the biosphere for what we believe are the hundreds of thousands of years necessary for it to decay to acceptable levels.

At the same time, we have opposed the MRS as an unnecessary and we believe unwise addition to the Federal high level waste program. I have got for the committee some copies of the Sierra Club board resolutions that deal with these issues.

The MRS has been a chameleon-like facility, I think, in the history of Federal waste management in the United States. It was originally conceived, I think, and you will remember and I know your staff will remember, as a retrievable surface storage facility that was conjured up by the Atomic Energy Commission after the failure of the geological program at Lyons, KS, in 1973.

And over the years since then, MRS's of various types and descriptions have had a lot of functions, at least in concept, including the permanent or semipermanent storage of spent fuel or high level wastes, interim storage of spent fuel prior to reprocessing, storage of spent fuel prior to disposal in a repository, preparation and temporary storage of spent fuel for transshipment to a repository, and finally providing a disposal system buffer to allow waste acceptance on a declared schedule despite any uncertainties in the development of a repository.

I think that as far as whether MRS should be conceived of or ought to be allowed to become an alternative to a repository, the Sierra Club is in fundamental agreement with the inter-agency review group that was commissioned under President Carter that considered that issue, where they said:

> Responsibility for establishing a waste management program should not be deferred to future generations. The system should not depend on the long term stability or operation of social and governmental institutions for the security of waste isolation after disposal.

Obviously, we are also concerned about a number of other aspects of indefinite surface storage, including the dangers of proliferation, sabotage, theft of weapons material, or future use or reprocessing of commercial wastes for defense purposes.

[The prepared statement of Mr. Yeager follows:]

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STATEMENT OF BROOKS B. YEAGER

WASHINGTON REPRESENTATIVE

REGARDING THE DEPARTMENT OF ENERGY'S PROPOSAL

FOR MONITORED RETRIEVABLE STORAGE (MRS)

AND THE ROLE OF MRS IN THE FEDERAL HIGH-LEVEL NUCLEAR WASTE PROGRAM

BEFORE THE SENATE COMMITTEE ON ENERGY AND NATURAL RESOURCES

HONORABLE J. BENNETT JOHNSTON, CHAIRMAN

APRIL 29, 1987

"When we try to pick out anything by itself, we find it hitched to everything else in the universe." *John Muir*

National Headquarters: 730 Polk Street, San Francisco, California 94109 (415) 776-2211

Mr. Chairman, Members of the Committee,

Thank you for the opportunity to present the views of the Sierra Club on the Department of Energy's program for the management and disposal of high-level radioactive waste, and the role of the proposed "monitored retrievable" storage facility (MRS) in the program.

The Sierra Club is a national conservation organization with over 400,000 members dedicated to protecting our natural resources and the environment. We have members in each of the states under consideration for the development of repository and MRS facilities, and also in the states in which commercial and defense wastes are now in temporary storage. We have taken an active interest in the implementation of the Nuclear Waste Policy Act from its inception.

As a matter of national policy, the Sierra Club agrees that the Federal Government should have responsibility for the final disposal of commercial, as well as defense nuclear waste, and that geologic disposal offers the most promising technical option for isolating this lethal material from the biosphere for the hundreds of thousands of years necessary for it to decay to acceptable levels.

We also oppose MRS as an unnecessary and unwise addition to the Federal high-level waste program. I have attached the various policy resolutions adopted by the Sierra Club's Board of Directors for the information of the Committee.

THE FUNCTION OF THE MRS IN DOE'S "REVISED" NUCLEAR WASTE PROGRAM

Facilities for the surface storage of high-level nuclear waste, whether under the name of "monitored retrievable storage" (MRS), or "retrievable surface storage facility" (RSSF), have been considered for many years as potential supplements-to, or substitutes for, disposal in geologic repositories. Various functions have been contemplated for such facilities, including: 1) permanent or semi-permanent storage of spent fuel or high-level waste; 2) interim storage of spent fuel prior to reprocessing; 3) storage of spent fuel prior to disposal in a repository; 4) preparation and temporary storage of spent fuel for transhipment to a repository; and 5) providing a disposal system "buffer" to allow waste acceptance on a declared schedule despite any uncertainties in the development of a final repository. (Cf. Report to the President by the Interagency Review Group on Nuclear Waste Management, March 1979; The Monitored Retrievable Storage Concept, U.S. DOE, December 1981; Mission Plan for the Civilian Radioactive Waste Management Program, Vol. 1, U.S. DOE, June 1985; Draft Mission Plan Amendment, U.S. DOE, January, 1987.)

The Atomic Energy Commission first proposed the idea of permanent retrievable surface storage as an alternative to geological disposal after its proposal to site the nation's first HLW repository underneath Lyons, Kansas was abandoned in 1973. Yet, despite the superficial attraction of the surface storage concept, it had been largely rejected by 1979, when the Carter Administration's Interagency Review Group (IRG) formulated the basic policy which Congress later embodied in the Nuclear Waste Policy Act of 1982 (NWPA).

Although the possibility of indefinite surface storage of HLW raised many concerns about the proliferation, sabotage, or theft of weapons material, and about future use or reprocessing of commercial waste, perhaps the most telling argument against it was stated in the IRG's 1979 Report to the President:

> The responsibility for establishing a waste management program shall not be deferred to future generations. Moreover, the system should not depend on the long-term stability or operation of social and governmental institutions for the security of waste isolation after disposal. (IRG, p. 16)

Section 141 of the NWPA requires a DOE proposal for MRS, but does not authorize the development or construction of a facility. However, in establishing requirements for DOE's proposal, Congress did, to some extent, define what functions it considered appropriate for an MRS. The proposal must be for a facility licensed by the NRC, and capable of storing wastes for long periods of time. It must be "integrated" with other facilities authorized by the Act, but it must not be located in the same state with a geologic repository. One reasonable interpretation of Congressional intent for the facility is that it was envisioned as a long-term backup storage technology which would be available for authorization by the Congress and subsequent construction should a clear need arise.

DOE's initial post-NWPA concept of MRS, as embodied in the original Mission Plan, was for a facility which would fulfill functions 4) and 5) above; that is, which would be a center for the repackaging of spent fuel under shipment to a repository, and which would have sufficient storage space so that it could be used to maintain a stable waste acceptance schedule whether or not there were uncertainties in the waste loading schedule at the final geologic repository. DOE argued that such a facility would increase the efficiency and safety of spent fuel transportation to a repository, and would improve the performance of HLW delivery system by centralizing its transportation functions.

However, in a number of studies which followed the original MRS proposal, DOE's conclusions with regard to the benefits of the MRS in terms of transportation and system efficiency were disputed. (Cf. "The MRS: An Assessment of Its Need and Feasibility," William Colglazier, Forum for Applied Research and Public Policy, Spring 1985, "Status of Spent Fuel Technology Related to the DOE's MRS Proposal," R.E. Hoskins, Presentation to the Southern States Energy Board Advisory Committee on Radioactive Materials, February 10, 1987, and "Optimum MRS Site Location to Minimize Spent Fuel Transportation Impacts," R.E. Hoskins, Presentation to Waste Management '87 Symposium, March 3, 1987.) The conclusion of these studies, in summary, was that virtually all of the transportation efficiencies and system performance improvements claimed by DOE for the "integrated MRS" could be achieved by improved emphasis on transportation coordination and control, and without the development of an MRS facility. In addition, the studies pointed out that the addition of an MRS proposed by DOE would significantly increase the total transportation load of the spent fuel delivery system. Finally, they pointed out that the MRS would likely increase the total waste disposal system costs by at least $2 billion, with little additional benefit to system operations.

In the Revised Mission Plan submitted this January, the essential purposes of the MRS are described in a radically different fashion from the functions described in the original Mission Plan. They are: to allow "accelerated waste acceptance from the utilities;" to "significantly reduce the need for new temporary storage capacity at reactor sites and the attendant fuel-handling operations, licensing efforts, and costs;" and thus to "allow waste acceptance to begin by 1998," despite the fact that the nation's first HLW repository will not be available until 2003, five years after the date originally promised by the Department.

It is reasonable to question whether the new "benefits" identified for the MRS are worth the $2 billion plus which will be spent on the facility, and whether the incremental hazards associated with the increased transportation load which the MRS would entail are in any way justified.

It is also reasonable to question whether the alleged advantages of MRS construction warrant the strenuous political exertions which will be necessary to overcome the overwhelming opposition to the facility which currently exists among the people of Tennessee.

Finally, it may be worth examining whether these new "benefits" are actually likely to be achieved at all.

Judging from the most recent descriptions of the MRS in the Revised Mission Plan and the MRS submission itself, DOE now regards the facility primarily as a means of allowing the physical acceptance of spent fuel in 1998, despite the admitted fact that no repository will be available at that time.

In this context, it is reasonable to inquire how the 1998 date was originally arrived at, and whether it has any legitimate basis, either in terms of an achievable schedule for developing a repository system, or in terms of the capacity needs of utilities for at-reactor storage of spent fuel.

THE POLITICS OF THE 1998 WASTE ACCEPTANCE DEADLINE

Well before the 97th Congress took up the legislation that eventually emerged as the NWPA, DOE, following the broad outlines of the IRG recommendations, had put in place a program to investigate and bank potential repository sites and to develop a repository system for the permanent disposal of commercially generated HLW. That program is set out in detail in DOE's 1978 submissions in the so-called NRC "Waste Confidence" Rulemaking.

The DOE pre-NWPA program contemplated a site characterization and selection effort which would study 3 already identified sites (Hanford, Nevada, and WIPP), in addition to sites in three media: dome salt, bedded salt, and granitic rock. Each site would be subjected to a tiered environmental review, including the preparation of a full EIS prior to shaft drilling, with the results of in-depth site characterization being evaluated in another EIS for submission to the NRC as part of the application for a construction authorization. The schedule for repository development, assuming the initiation of full at-depth site characterization in 1982, projected the beginning of repository operations in the year 2006.

However, during the extended debate on the NWPA in the 97th Congress, DOE drastically altered the shape of the Carter Administration program. Under severe pressure from the nuclear industry and some key Congressional leaders to show faster progress on the road to a repository, DOE testified in favor of a repository development schedule fully eight years shorter than the program it had submitted to NRC.

Clearly, the 1998 date has never had much to do with any realistic assessment of the time necessary to develop the nation's first operating geologic HLW repository. DOE's admission, in its Revised Mission Plan, that no repository will open before 2003 should not have suprised anyone.

At the same time, the 1998 date seems to have little relation to any actual physical constraints on on-site disposal by the utilities. During the debate over the NWPA, the utility industry did claim that its spent fuel storage capacity, in terms of existing water pools, was severely limited, and in fact asserted that many reactors would have to cease operations unless Away From Reactor storage (AFR) was made available by the Federal government. However, the critical dates asserted by the utilities for this storage crisis have already passed. Although the Congress was enough persuaded by the utilities' complaints to provide for a limited last resort AFR, the Act clearly indicates a Congressional preference for the expansion of at-reactor capacity, and in fact provides expedited licensing procedures for certain on-site capacity expansions. There is no evidence that Congress considered the MRS to be an answer to the short-term capacity needs alleged by the utilities; and in fact, the lengthy timeline contemplated by the Congress for the authorization, construction, and licensing of the MRS clearly makes it unavailable for such a purpose.

Since the passage of the NWPA, the emerging technology of modular dry cask spent fuel storage has largely mooted the storage "crisis" predicted by the utilities. Dry casks are already in use at some utilities, including VEPCO and TVA, and there seems to be little obvious restriction which would prevent them from being widely available to utilities as a low-cost method of incrementally increasing at-reactor storage capacity.

It can legitimately be argued that the presence of the NWPA's 1998 deadline reflects DOE's failure, during the evolution of the Act, to distinguish the government's interest in assuring the establishment of a safe and responsible disposal system from the interest of the nuclear industry and private utilities in forcing government responsibility and physical custody of nuclear waste at the earliest possible date.

THE MRS: A TWO BILLION DOLLAR SAFETY VALVE WHICH MAY NOT WORK

Judging by the evidence in the Revised Mission Plan, this unfortunate confusion of goals is still central to DOE's concept of its mission and obligations under the Act. It is clear, in other words, that despite all the other ancillary claims that are made for the MRS, the central function of the facility in the revised DOE HLW program is to ensure that DOE can still begin the physical acceptance of utility spent fuel on the unrealistic schedule to which the Department committed itself in 1982.

The MRS has become a safety valve for a failed repository program. In that capacity, it is a legitimate concern of the people of Tennessee that the safety valve could all too easily turn into a de-facto surface repository for HLW.

The technical problems associated with the first round repository sites chosen by the Department are of a fundamental, not a trivial nature. In the view of many observers of the program, it is entirely possible that none of the first round sites will prove out under intense investigation. In such circumstances, an already authorized long-term storage facility, even one with statutorily limited capacity, may prove to have an irresistible political appeal, no matter what its real-world drawbacks may be.

In order to address this problem, DOE has proposed to link the operation of the MRS to the timing for a construction authorization for a repository. However, as noted by Colglazier (op. cit.), such a linkage, if it could be enforced, would actually vitiate one of the chief advantages claimed by the Department for the facility: that it would allow the "decoupling" of the repository loading and waste acceptance schedules, so that uncertainties in repository development would not affect the predictability of the spent fuel shipment schedule.

Even if a succeeding Congress should sever the link tying the MRS development schedule to the repository construction authorization, it may not be possible to bring a facility into operation by 1998. In the Revised Mission Plan, DOE indicates that the 1998 MRS start-up debate is only possible with "prompt authorization." A look at the MRS Program Plan, which is the third volume of DOE's Congressional submission, explains why.

The so-called "critical path" for MRS development, as projected by DOE, will take a minimum of 10 years. Given DOE's record in meeting other program timelines, and the fact that there are no licensing precedents for a central storage facility of the type envisioned by the Department, one would have to regard this critical path as optimistic at best. If one adds to this bleak picture the profound disaffection and resentment felt towards DOE and its proposed facility in Tennessee, it is only realistic to assume that the MRS schedule, like so many of DOE's other schedules, is a pipe dream.

ALTERNATIVES TO THE "BACKSTOP STORAGE" OFFERED BY MRS

As indicated in the studies of Colglazier and Hoskins, the system performance benefits claimed for MRS can be achieved without the expense and disadvantages associated with the facility proposed by DOE. In addition, the ability of utilities to utilize modular dry storage technologies on-site means that there is no near-term capacity crunch which makes a central storage facility necessary.

However, utilities may legitimately argue that they should not be financially penalized by being forced to pay for dry cask storage when they are already paying into a waste fund to develop a disposal system which the Department promised would be in operation by 1998. In order to resolve this problem, the Sierra Club believes that legislation could be enacted to allow utilities to claim credit against their obligations to the waste fund to cover expenses for additional on-site spent fuel storage after 1993. Such legislation would clearly indicate a Congressional view that the preferred method for continuing interim storage of spent fuel prior to the opening of a repository is by incremental additions to at-reactor storage. It would avoid the financial disadvantages, increased spent fuel transport, and safety hazards associated with MRS, while also ensuring that utilities are not financially penalized for the failure of the Department to meet its self-imposed disposal deadlines.

THE CURRENT STATUS OF THE HLW REPOSITORY SITING PROGRAM

Four years after the passage of the NWPA, the DOE HLW repository site selection effort is in disintegration. The site selection guidelines developed by DOE pursuant to Section 112 of the Act are under court challenge, as are the environmental assessments on the first round sites. The first round site selection effort itself, already running two years late, has been suspended by Congress. This Congressional suspension reflects not only political opposition to the selection of the Washington, Nevada, and Texas sites, but also deep-seated and well-founded misgivings with regard to the rigor and technical adequacy of DOE's siting and ranking decisions.

The effort to screen favorable rock formations for the so-called second-round repository has been indefinitely deferred by the Department. This decision was apparently based on political considerations, although the Department has attempted strenuously to justify it after the fact.

The Department's attempts at the ex post facto legitimation of the effective cancellation of the second round, as contained in testimony delivered by Secretary Herrington and OCRWM Director Rusche at the time of the submission of the Revised Mission Plan have been blatantly self-contradictory.

Secretary Herrington at first asserted, before this Committee, that unless Congress explicitly rejected the revised plan through legislation, DOE would construe the lack of a response as tacit agreement, and would move forward with the revised program. Within a week, Director Rusche had reversed that position before the House Subcommittee on Energy and Power, asserting that, unless Congress explicitly confirmed the revised program through legislation, DOE would restart the second round siting program this year. One can hardly blame those from eastern states who view this latest DOE declaration as thinly-disguised regional blackmail.

Although we believe that the legislation introduced by the Chairman and Ranking Member was introduced with the legitimate intention of salvaging the site selection program and proceeding towards the development of an licensable repository, we do not believe it can achieve those goals. No state is likely to accept the offer of S.839, in which it would essentially give up all legal rights to challenge DOE decisions made as part of an incentive agreement. To accept such an agreement, I am afraid, would be the modern political version of "giving up your birthright for a mess of pottage."

Yet, as a result of the partisan and regional tensions cause by the obviously political nature of DOE's key program decisions, Congress may have extreme difficulty in making the necessary changes to set this program on a more sound footing.

We believe it will be necessary for Congress to continue the suspension of the siting effort, and to establish a mechanism for the review of DOE's implementation of the NWPA to date. Such a review panel or commission, which could be based on suggestions which have been made by Governors Gardiner and Clements, should be instructed not only to evaluate DOE's technical and institutional performance in the course of the site selection and systems development for a repository, but also to make recommendations to the Congress as to the changes which may be necessary in order to establish a siting program which has a greater probability of achieving the national goal of developing a safe, publicly acceptable repository. Pending Congressional action to redirect the siting program, further site characterization efforts based on the current program are merely a waste of money on an effort with little likelihood of achieving its declared aims.

The CHAIRMAN. Let me interrupt you at that point. I cannot conceive that there is a danger of proliferation from storage of waste in an MRS, of terrorists getting a hold of this stuff. That is high level wastes. You would have to be a very sophisticated country.

It would be only a country that could steal the stuff, and then you would have to reprocess it.

Mr. YEAGER. It might not have to be by theft. As long as it is on the surface of the earth, the proliferation is always a danger. It could be by the choice of a government. There are certainly European governments now who are willing to cross the line between the use of civilian nuclear material for defense purposes—France.

The CHAIRMAN. They reprocess it.

Mr. YEAGER. And to reprocess.

And in the Carter administration, their advocacy of the once-through fuel cycle was to eliminate that possibility.

The CHAIRMAN. You would have to have a brandnew decision to reprocess. And the MRS does not—is not a step towards reprocessing. It is a step toward cooling it. Actually, I think under the Act, am I not correct that even under the repository they must be retrievable?

Mr. RUSCHE. The first 50 to 100 years.

The CHAIRMAN. Well——

Mr. YEAGER. That was a consideration that was drawn from the NRC technical regulations. It had to do with, if you found that there had been a screw-up somehow with the repository, you want to be able to get the stuff back out after years.

The CHAIRMAN. I think I can tell you that, while some members of the committee are interested in reprocessing——

Mr. YEAGER. I was here yesterday morning. I noted.

The CHAIRMAN. I do not think that is going to happen, because the economic studies—and they have done some economic studies in Europe. The economics are simply against it, and I do not expect a turn around in that.

They did a study, by the way—we have a copy of it—of reprocessing under three different scenarios of the price of uranium, and under all three, I forget what those prices were, but today's price and two higher prices. And in each of those scenarios, they determined that reprocessing is not economic.

And I expect those economics to stay that way. So MRS is not a step or a desire to get reprocessing.

Mr. YEAGER. I was attempting to indicate the basis of some of the worries that we have had in the past about MRS that have led to our policy.

But in order to talk about the concept now, I wanted to just show—and I think in my written statement I went through it—how the concept of what the MRS would be used for has changed over the years.

Until now, far from being either an alternative really or a packaging and handling facility of the kind that DOE proposed in its mission plan a year and a half ago, we really have an MRS as a safety valve for a failed or failing repository program.

I think that it's fairly clear, if you look at the testimony of the Department of Energy or at the revised mission plan, that the advantages that they are pointing up now are the advantages of being able to meet the 1998 waste acceptance date that they have committed themselves to in their contracts with the utilities.

And although I think a legal commitment of that kind should be taken seriously, that also causes me to reflect that really the Department of Energy advocated that schedule during the debate on the act in 1981 and 1982, that in fact other schedules, longer schedules, were advocated by other parties, observers of the system and people who had some reason to believe that it would take longer than the time that DOE thought it would take to achieve an operating repository.

And now what we are being told is that the chief advantage of an MRS is it will allow us to keep our schedule, the schedule that the Department of Energy promised to keep. And I think if that is the chief mission of an MRS, then I think the committee needs to ask very seriously whether it is worth the expense to do that, whether it is worth overriding the serious objections of a large majority of the people in Tennessee to keep that date, and whether it is worth adding incrementally to the transportation load on the system, which, although some studies have indicated that the danger would only be slightly increased, still the more you transport spent fuel around the country the higher likelihood there is that some truck or train is going to have an accident.

The CHAIRMAN. Do you believe that transportation of nuclear waste is a real danger?

Mr. YEAGER. I believe that it can pose a real danger. I believe that the studies show that compared to, for instance, storage at either a central facility or a dispersed storage of the kind that exists now, transportation poses a higher danger.

I think as a general objective we would want to keep the transportation load as low as possible in getting to a final repository.

The CHAIRMAN. Well, the experience in Europe has been, and the advice we got there, is that the danger of nuclear transportation is virtually nil. And I think that the Department of Energy says the same thing. You are transporting the wastes in containers that are supposed to be crash proof.

We asked them in Europe: What happens if the container breaks open? They said that cannot happen. We say: No, the worst happens and the container breaks open; what happens? But you do not understand; that cannot.

We say: Well, we want to know what happens. And when you ask what happens when the container breaks open, which it cannot, but if it does, then the scale of the accident is so much less than when chemical containers break open.

You do not say it is trivial that a container has broken open, but it is not like an LP gas fire that sets the whole neighborhood on fire or an explosion, or even ammonia gas that creeps around. And certainly compared to most any other thing you transport, it is relatively benign.

Now, am I incorrect on that?

Mr. YEAGER. I cannot give you a quantitative assessment. I agree with you that many forms of hazardous waste transportation, particularly of combustible wastes, are probably more immediately dangerous.

But I also, from the studies I have seen, believe that the casks which we are planning to use to transport wastes at this point have not been destructively tested. In fact, the destructive tests which we often see the movies of were of a prior generation of casks which are no longer in use.

And the only testing that I am aware of that has been done on the casks in use now is computer modeling, essentially.

The CHAIRMAN. I have Ben Rusche here, and that is a nice thing about him. When he sticks around, we can get a little dialogue going.

Tell us about those casks, if you would.

Mr. RUSCHE. Mr. Chairman, the casks that are of a future generation, that is yet to be designed, of course have not been destructively tested. We do have a procurement action in which we are developing perhaps as much as ten, as many as ten different designs, each of which will not only be computer modeled but will be tested to assure their performance under the circumstances we are talking about.

All of the casks that will be used for moving fuel in this program are NRC-certified and DOT-certified. And I believe that Mr. Yeager's assertion that they have not been destructively tested may carry an impression that some casks are therefore defective or faulty. I believe that is unwarranted.

The CHAIRMAN. In other words, they have not been tested because they have not yet been fully designed?

Mr. RUSCHE. For the new ones, that is correct. And the ones that have been tested are of course of a generation that now currently exists, and they have been tested.

The CHAIRMAN. Will the new ones be as strong as the old ones?

Mr. RUSCHE. Or better.

The CHAIRMAN. Thank you.

I am sorry for that interruption.

Mr. YEAGER. That is quite all right.

I think that, to follow on a little more about the 1998 date, it apparently never really had much reality as far as the actual time line that it was expected to take to arrive at an operating geological repository. And I have gone in my testimony into that a little bit.

But in fact, the Carter administration submission to the NRC in the waste confidence program, which was the first comprehensive description of a Department of Energy repository selection and development program, contemplated starting site characterization in 1982, but not arriving at an operating waste repository until 2008.

Now, clearly some time in 1980, 1981, the Department of Energy decided that they could do it a lot faster. And now it turns out that they were wrong.

The second point about the 1998 date is, as Mr. Rusche testified, it does not have any relation to the ability of utilities to continue—there is no utility storage crunch that is going to make utilities close down, as was asserted during the debate over the 1982 Nuclear Waste Policy Act. That is—and I know you will remember all of this—there was a great hue and cry to develop so-called away from reactor storage, to solve a short term facility storage crisis.

Generally, I think it is accepted now that the advent of dry storage technologies of the kind actually that would be used in an MRS or that would be used onsite at reactors has mooted that question and made that storage crisis——

The CHAIRMAN. May I interrupt you to ask what you think of the design? I mean, aside from the fact of whether it is necessary or advisable to have an MRS, what do you think about this design?

Mr. YEAGER. As far as being a design which uses a passive dry cask storage technology, the Sierra Club has generally felt that dry cask storage for temporary storage of spent fuel is a reasonably safe method to go. That is, in many cases at reactors we believe dry casks may be preferable to consolidation in water pools.

I do not think the chief problem with MRS arises from the danger that would be represented on site at the storage site, although there are some scenarios—and you mentioned one of them—airplane crash, a good target for a small scale nuclear attack, that kind of thing.

But as far as ordinary events, that does not seem to be the chief problem. The chief problem seems to be that it centralizes the transportation mode, causes excess transportation, is probably unnecessary, and may become a de facto substitute for a repository.

The CHAIRMAN. Let me just say on that point, it bears repeating—I have said it before, but it bears repeating. It is the clear scheme of this law, enacted after not just in one Congress, but over a long period of time, to have a permanent repository.

We have heard the repository program described in various ways, as being in shambles and all of that. I really do not think that that is true. I think those states which object to having a repository would like to say it is in shambles, and when they come up and make technical objections, you know, we say, what is your real objection to this?

They say some things which turn out not to be really technical objections, or they are possible technical objections which can be resolved only by characterization. For example, as I have described two of those which the State of Nevada went into in great detail.

That is why we are going to spend a billion dollars apiece on characterization. But the repository program is alive and well. It is in the law. It is in a past Act of Congress.

And if I were thinking about whether it is probable or not probable that waste is going to be put in a repository, I would look to that act of Congress and I would say it is not only probable, it is going to happen, because it has to be put somewhere and you have an act.

If you had to pass an act to do it and overcome a filibuster and put together the coalitions which it takes to pass an act, that would be different. But the repository is going to happen.

Mr. YEAGER. Senator, you have a lot more influence over whether that, the repository program, is alive and well than I do. But as an observer, I would say that it may be alive, but it is not well.

The CHAIRMAN. Well, it may not be well, but it is certainly not popular.

Mr. YEAGER. It is more than not popular. We have clear evidence that has been presented to committees in the Congress that the first round repository siting effort has been plagued by what I would only regard as numbers juggling.

You are aware of the fact that the second round repositories were dropped, or the second round effort was essentially stalled, was——

The **Chairman**. That was very unfortunate.

Mr. **Yeager**. Which is bound to lead three States in the West to conclude that they have been picked on in an arbitrary capricious basis.

The **Chairman**. We have had long discussions in this Committee criticizing DOE for what they have done. That was an unnecessary flight from credibility.

Mr. **Yeager**. I have gotten so far in my statement now, let me just go one paragraph farther.

I was here yesterday morning and I noted that you received testimony that said essentially this process is very easy. And it led me to conclude, why have I been worrying about this for so long? This can be done anywhere. We can site a geologic repository in New Jersey tomorrow and it would be perfectly safe.

I do not think that is the case, and I think that it would be good for people to be aware that large studies have been published by credible scientists with the title "Uncertainties in geological disposal of high level nuclear waste."

Or it would be good for people to read through NRC staff comments on the five first round sites and see that the majority of the comments that they feel were major concerns that they raised in connection with the draft environmental assessments were not satisfied in the final environmental assessments.

Now, I am not saying that I as a citizen can sit here and tell you that none of those sites could prove out. What I am saying is that we seem to have a program that is running on the theory that unless we come across some awfully—some awful disqualifying fact about a site, we should go forward with it.

Whereas we believe that to some extent, in a situation this unprecedented, we ought to have a program that goes forward on the basis that we need to try to find out every defect we can in the site before we invest enormous institutional and financial resources in it.

The **Chairman**. You see, we are investing enormous financial resources right now, before we even characterize. What was the budget last year?

Mr. **Rusche**. About $500.

The **Chairman**. $500 million. That was the reduced budget. That is some serious dollars. So we ought to get on with characterization which is designed to answer these questions.

There is no way that I know of that you can pick these sites and answer simultaneously—pick your sites for characterization and be able to answer all the potential defects about them, because those defects, those objections, can be answered only by characterization.

And I do not mean to make light of defects that DOE may have had in the administration of the act. I think they have made a lot of mistakes, and you identified one lulu with the eastern repository.

But from our standpoint—and I am trying to run this committee in as fair and thorough a way as we can—and it was suggested to me, well look, you need to restore credibility to the program, you ought to stop the process, go back, have an investigation, and then start all over again.

Well, I can tell you, we have got an act of Congress. It may not be a perfect one. We are not going to give that up, amend that act and have some kind of moratorium, without having something else in mind, something else passed by the Congress. That is number one.

No. 2, it seems to me that we here in this committee, with committee staff which are experts in the field and have been dealing with it for a long time, and with access to experts—I mean, we can even get the Sierra Club to come in and testify. Really, that is important.

And we can get people to come in and testify and play to some extent that role of the impartial commissioner. We are political. We may not be—we may have some preconceived decisions, but we really want this program to work. That is my only interest.

And I think I speak for the other members of the committee, except perhaps those who have potential sites in their State. They may have a secondary interest to get the site out of their State, I do not know. But I think the committee really wants to go about this as fairly as possible.

It seems to me that the act is far from being perfect, but it is working and it is legal, and I hope we can restore credibility, because, you know, we go over to Sweden and we go over to France and the nuclear programs in those States may be in some problems, but not the waste disposal. Waste disposal is going along swimmingly. They are operating their waste disposal programs.

One more question and I will let you all go at this late hour, unless you have something further to add. Have you looked at S. 839?

Mr. **Yeager**. We have. My belief is that S. 839—and we believe that it was intentioned well in the sense of trying to push the repository program along. I do not believe that it will work, because I do not believe that it fundamentally addresses the problems which really have caused the credibility crisis of the program.

I think that you are going to find it very difficult for any Governor or State to accept the location of a repository by a program which has been plagued by so many allegedly or chargeably or perhaps honestly arbitrary or politicized judgments.

I mean, this brings us to the problem that we were just addressing, whether or not we need to put things on hold for a second and take a long look at this program. I believe we do. I think there are some good reasons to do that, that cannot be very easily resolved within the context of an ongoing site characterization effort.

I do not mean that we should stop indefinitely, but it seems to me that at this point you have got a program with a credibility crisis the likes of which I have never seen, and I am getting older.

The **Chairman**. Oh, we have had these before.

Mr. **Yeager**. And I think that no one accepts, hard as Ben Rusche may work—and I think that he is a hard working civil servant—there are very few people out there in the countryside right now who believe that DOE is trying to put up high hurdles for itself and hurdle them.

What they believe is that the Department of Energy is attempting to find its way through what it regards as a network of obstructions and problematic kinds of regulatory experiences and still manage to get a repository sited in time to help out the utilities.

And people are not happy with the experience they have had, and it is more than not happy. They are extremely distrustful, and at this point, as Mr. Bradford testified, the whole credibility system that was built in the Act is on very shaky ground.

It seems to me that you need to rescue not only the technical credibility of the siting program, but some examination needs to be made of the relationship of DOE and its contractors to the program, of whether contractors, as has happened in the past, are overoptimistically judging sites because if the site is developed they will make a lot of money from it.

I think you need a chance to look at whether the DOE should continue to be the managing entity of the program. And I do not think that is going to be very easy to do in the context of the incredible regional and partisan tensions that I saw in this Committee last year as a result of DOE's second round decision.

The **Chairman**. Who else might manage it other than DOE?

Mr. **Yeager**. I think a panel of the kind—excuse me. Who might manage the program? It has been suggested in the past that a single agency might be created to manage this program.

I do not pretend to solve that, but it seems to me that you—it might be good to set up a mechanism by which Congress can look at that problem and see whether that might be a more efficacious way of taking the program forward.

The **Chairman**. The problem is, I take it, with all of the faults of DOE—and they have some faults—it is very difficult to set up a brand new organization.

I mentioned the Synfuels Corp. because I had a lot to do with setting up the Synfuels Corp., and I can tell you, if you think you can set up a corporation and have it have instant credibility, I do not care who it is—if we had the National Academy of Sciences to run that corporation, in the first place it would take them a long time to get started. It would take us a long time to design the program.

You would probably end up using the same contractors. Your concern about the contractors is a very real one to me. That is one of the concerns I have about costs. You know, the contractors saying, well, yeah, we need to double gold-plate this thing, you know, out of which they make an extra billion dollars, and DOE saying, well, maybe we should not.

But the contractor is then saying: Well, this is public safety. I want to do everything we can for public safety, but I do not want to spend an extra few billion dollars of public money on this thing.

One of the things I spoke about yesterday was some oversight capacity from the question of cost. If you have got some suggestions on that, without sacrificing safety, but just on cost, I would like your suggestions or anyone's suggestions on that.

Mr. Berry, if you all have some suggestions on that. I do not want to have a lot of new legal hoops to jump through, but if we just had somebody good, with good judgment, to oversee the expenditure of this money, like an inspector general for costs—and I do not imply anything about Ben Rusche.

I have said too many good things about him already. He is going to get a swelled ahead because of all the compliments he has gotten today from me. But any administrator ought to have somebody looking over the program, whether it is OMB or whether it is the inspector general or whoever, because there is potential for enormous waste in this program.

Mr. Berry, what are your comments on that?

Mr. **Berry**. Well, we in the industry have created a committee that in our best way is trying to oversee what DOE is doing in terms of cost as well as progress, the American Committee on Radioactive Waste Disposal, which includes both publicly owned and privately owned utilities.

We meet regularly, review the program. We send teams of our experts out to the sites to see what DOE is doing and review their schedule. We at our expense brought in a money manager to review how DOE was investing the money and made some suggestions to them as to how they can maybe generate a little more interest than they were generating on our customers' money, which they have adopted and I think they have made some money out of it.

So as best we can within the constraints of the law, we are trying to look over their shoulder, because they are spending our customers' money.

The **Chairman**. Well, I would like on an ongoing basis any suggestions you may have, or you, Mr. Yeager, or Mr. Bradford or anyone else, about how we might deal with that problem. Maybe it is not a problem. Maybe it is—maybe we were comparing apples and oranges when we talked about the comparison between what they can do in Sweden and France with what they can do here.

At least I was persuaded that that was so when Mr. Rusche gave the projected cost of the MRS today. That is more reasonable compared to those costs of Forsmark, Oskarshamn, and La Hague.

In any event, we would like your advice on that.

Well, gentlemen, I appreciate your being here so late. Does anyone have any final comment to make before we close down this hearing?

Mr. **Bradford**. I should perhaps just clarify—I was not sure whether you had me in mind when you said it—that neither NARUC nor I personally have urged that the program be stopped while an overview be taken.

The **Chairman**. Say that again?

Mr. **Bradford**. Neither NARUC nor I have urged that the program be stopped while an overview of it be undertaken. I do feel that an overview of the sort that we talked about would be helpful, and it is probably essential. But in most respects, I would think that at least many aspects of the program could continue while that was going on.

The **Chairman**. Well, there is an overview of—I guess you would call this an overview of sorts that is going on right now with the committee. And the National Academy of Sciences, as you know, has a team constantly monitoring and making suggestions, as does the Nuclear Regulatory Commission.

The Nuclear Regulatory Commission obviously is charged not only with the overview, but with the licensing process. So that is an ongoing process.

If you can suggest ways in which we might, upon reflection, if any of you have ways in which we could add credibility to this process by further study, we would be glad to hear that. As you can see, I do not favor a moratorium or delay, but we will consider any good suggestion along that line.

Again, thank you very much. You have been very patient to stay here this long.

[Whereupon, at 5:50 p.m., the hearing was adjourned.]

APPENDIXES

Appendix I

Responses to Additional Committee Questions From the April 28 and 29, 1987 Hearings

Department of Energy
Washington, DC 20585

June 22, 1987

Honorable J. Bennett Johnston
Chairman
Committee on Energy and Natural
Resources
United States Senate
Washington, D.C. 20510

Dear Mr. Chairman:

On April 28 and 29, 1987, Ben C. Rusche, Director, Office of Civilian Radioactive Waste Management appeared before the Committee on Energy and Natural Resources to discuss the civilian radioactive waste program and the monitored retrievable storage proposal.

Following that hearing, you submitted written questions for our response to supplement the record. Enclosed are the answers to those questions, which also have been sent directly to the Committee staff.

If you have any questions please have your staff call Mike Gilmore or Tom Todd on 586-4277. They will be happy to assist you.

Sincerely,

Robert G. Rabben
Assistant General Counsel
for Legislation

Enclosures

POST-HEARING QUESTIONS AND ANSWERS

U.S. DEPARTMENT OF ENERGY

APRIL 28 AND 29, 1987

QUESTIONS FROM CHAIRMAN JOHNSTON

QUESTION 1: On April 30, 1987, Tennessee Governor Ned Ray McWherter filed a complaint in the United States District Court for the District of Columbia (No. 87-1184) seeking a declaratory judgement to determine the timeliness of the exercise of the state's rights under sections 141(h) and 116(b) of the Nuclear Waste Policy Act (NWPA). As you know, these provisions relate to a state's right to veto the siting of nuclear waste facilities.

Please provide the Committee with the Department's legal position on the matter of the timeliness of the exercise of these rights. In addition please provide the Department's position on how the matter of the state's veto under the NWPA applies in the case of the monitored retrievable storage facilities under section 141. Include in your response a description of the process through which the state in which a monitored retrievable storage facility is to be sited can exercise the rights granted under section 141 and the Department's plans with regard to thise process in te event that the proposed MRC facility in Tennessee is approved by Congress.

ANSWER: Section 141(b) of the NWPA provides that "[a]ny facility authorized pursuant to this section shall be subject to the provisions of sections 115, 116(a), 116(b), 116(d), 117 and 118. For purposes of carrying out the provisions of this subsection, any reference in sections 115 through 118 to a repository shall be considered to refer to a monitored retrievable storage facility." Section 116(b) of the Act provides that the governor or legislature may submit a notice of disapproval of a site for a repository in that state within 60 days after that site is recommended by the President to the Congress pursuant to section 114(a)(2)(A) of the Act. It is thus clear that sections 141(h) and 116(b) combine to provide a governor and legislature the statutory right to submit a notice of disapproval for an MRS facility, and that issuance of such a notice acts to restrain implementation of the authorizing legislation unless the Congress passes a resolution of respository (MRS) siting pursuant to section 115 of the Act. The Department believes that the principle was well established in Tennessee v. Herrington, 806 F. 2d 642 (6th Cir. 1986) that the term "authorized" in section 141(b) means "authorized by Congress," and therefore that the State of Tennessee will not be able to timely excercise its right to submit a notice of disapproval until Congress has acted to authorize an MRS facility.

Although the Act is silent as to when after authorization the state's right to a notice of disapproval vests, the Department believes that the proper application of the respository siting provisions of the Act to the MRS process, as provided by section 141(h), is that the 60-day period for the state to submit a notice of disapproval commences when the MRS authorizing legislation becomes law and a site for the facility has been selected. That is the point in time most analogous to the section 114(a)(2)(A) Presidential site recommendation to Congress which initiates the 60-day notice of disapproval period in the repository siting process. At that time, the MRS site will have been identified and the facility will have been authorized. This is the same combination of events necessary for the State's notice-of-disapproval right to vest in the repository siting process.

Under the Act the Department does not have a role in the consideration of a section 116(b) notice of disapproval submitted by a state. However, the Department would be available to provide information to the Congress during its deliberations on the MRS proposal, and would thus anticipate also being available to respond to any questions raised by the notice, and, in particular, by the statement of reasons explaining why the governor or legislature exercised their right to disapprove the authorized site, as provided for in section 116(b)(2) of the Act.

QUESTIONS FROM CHAIRMAN JOHNSTON

QUESTION 2: In a letter to me written on September 7, 1984, Energy Secretary Donald Paul Hodel described the obligation of the Department of Energy and its authority to accept spent fuel in 1998 as follows:

"Pursuant to my authority, it is my intention that this commitment in the contracts, together with the overall thrust of the Act, will create an obligation for the Department to accept spent fuel in 1998 whether or not a repository is in operation. This should enable utilities to plan for their projected waste disposal needs with confidence and certainty.

With regard to your question concerning whether the Department has the authority to accept spent fuel and high level radioactive waste in the event a repository is not yet fully operational, I have been advised by the General Counsel that Section 302(a) of the Act vests the Department with the necessary authority to accept spent fuel and high level radioactive waste beginning January 31, 1998, in such a circumstance."

Copies of the relevant correspondence are attached.

This letter seems to indicate that the Department has both the legal obligation and the necessary authority to take the fuel and waste beginning January 31, 1998. Yet there continues to be concern that the Department will not live up to this obligation.

For example, Ben Rusche, Director of the Office of Civilian Nuclear Waste Management, is reported to have testified to the Senate Committee on Environment and Public Works on April 23 that:

"We certainly have an obligation to accept waste beginning in 1998. But whether we can take title to it or have to actually take it is open to question."

QUESTION 2: (con't.)

Is the acceptance of spent fuel by the Department beginning in 1998 open to question? If so, please explain how and why, with particular emphasis on your plans in the event you do not take the fuel and the resulting exposure of the government to legal action and cost.

ANSWER: Given the 5-year extension in the repository schedule, if Congress does not authorize construction of the MRS the Department would have no authorized facilities available to accept spent fuel in 1998. Under such circumstances, the utilities would continue to be responsible for storing spent fuel at the reactor sites.

The Nuclear Waste Policy Act mandated that this be a full-cost recovery program, and established a separate fund, the Nuclear Waste Fund (NWF), to finance the program. The NWF is comprised of fees paid by owners and generators of spent nuclear fuel and high-level radioactive waste. Therefore, financial exposure, if any, resulting from legal action would be limited to the Nuclear Waste Fund.

THE SECRETARY OF ENERGY
WASHINGTON, D.C. 20585

September 7, 1984

Honorable J. Bennett Johnston
Ranking Minority Member
Committee on Energy and
  Natural Resources
United States Senate
Washington, D. C. 20510

Dear Senator Johnston:

I am writing in response to your letter of June 21, 1984, which dealt with disposal of spent nuclear fuel under the Nuclear Waste Policy Act. In your letter, you expressed dissatisfaction with the completeness of the General Counsel's response of May 30, 1984, and stated you had requested "an opinion on the legal obligation of the Department and the Department's authority to take title to spent nuclear fuel in the event that a repository has not yet commenced operation" by January 31, 1998.

In our original letter, the Department stated a firm commitment to accept for disposal, on an orderly schedule, high level radioactive waste and spent nuclear fuel not later than January 31, 1998. The Nuclear Waste Policy Act provides clear intent and direction for acceptance and disposal of spent fuel and high level radioactive waste by the Department. The Department is authorized to implement the Act through contractual commitments. To this end, the Department plans to incorporate into its contracts provisions which specify the minimum amount of spent fuel and waste which the Department will be obligated to accept, not later than January 31, 1998. Since these contracts have not yet been modified, it would be premature for the Department to speculate on particulars that might ultimately be incorporated in any or all of the contracts. However, unless waived, the usual remedies and defenses provided to parties contracting with the government would be available. Pursuant to my authority, it is my intention that this commitment in the contracts, together with the overall thrust of the Act, will create an obligation for the Department to accept spent fuel in 1998 whether or not a repository is in operation. This should enable utilities to plan for their projected waste disposal needs with confidence and certainty.

With regard to your question concerning whether the Department has the authority to accept spent fuel and high level radioactive waste in the event a repository is not yet fully operational, I have been advised by the General Counsel that section 302(a)(1) of the Act vests the Department with the necessary authority to accept spent fuel and high level radioactive waste beginning January 31, 1998, in such a circumstance.

As you know, there is much to be done between now and the 1998 date to ensure that we meet this deadline. I would like to personally assure you that the Department is totally committed to achieving this objective.

I hope this information has been helpful and responsive to your request. If I may be of any additional assistance, please do not hesitate to call upon me.

Sincerely,

Donald Paul Hodel

DONALD PAUL HODEL

cc: Honorable James A. McClure
Chairman, Committee on Energy
and Natural Resources

JAMES A. McCLURE, IDAHO, CHAIRMAN
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CHARLES A. TRABANDT, CHIEF COUNSEL
D. MICHAEL HARVEY, CHIEF COUNSEL FOR THE MINORITY

United States Senate
COMMITTEE ON
ENERGY AND NATURAL RESOURCES
WASHINGTON, D.C. 20510

June 21, 1984

Honorable Donald Paul Hodel
Secretary
U. S. Department of Energy
Washington, D.C. 20585

Dear Secretary Hodel:

For some time I have been concerned about the Department's nuclear waste program. In pursuing this concern, I have put several questions to Departmental spokesmen. Recently, I received a rather extraordinary letter from your General Counsel, Theodore J. Garrish, responding to a request that I had made of the Department for a memorandum on the Department's interpretation of certain provisions of the Nuclear Waste Policy Act of 1982.

I had asked for an opinion on the legal obligation of the Department and the Department's authority to take title to spent nuclear fuel in the event that a repository has not commenced operation. Garrish's reply was as follows: "...(W)e are not now in a position to analyze in any meaningful way the legal consequences raised by your question...". Copies of my original question and the Garrish response are attached.

The only sensible interpretation I can put on this response is that the Department does not want to provide an answer to my question.

However, I think the question I asked is an important one that deserves to be answered. The nuclear waste program is going to cost utility ratepayers billions of dollars. The assured acceptance by the Federal government of the utilities' spent nuclear fuel is the essential feature of this program, and the Department simply cannot expect Congress and other interested parties to tolerate uncertainty about the Department's view of the statutory basis for such acceptance.

I urge you to request the General Counsel to carry out the analysis I have requested, and carry it out promptly.

I look forward to an early reply to this request.

Sincerely,

J. Bennett Johnston
Ranking Minority Member

JBJ:bc

cc. Theodore J. Garrish

II. DOE Obligation to Accept Spent Fuel

1. Section 302(a)(5) of the Nuclear Waste Policy Act of 1982 specifies that contracts between the Secretary and generators and owners of spent fuel of high-level radioactive waste shall provide that -

> "(A) following commencement of operation of a repository, the Secretary shall take title to the high-level radioactive waste or spent nuclear fuel involved as expeditiously as practicable upon the request of the generator or owner of such waste or spent fuel; and
>
> "(B) in return for payment of fees established by this section, the Secretary, beginning not later than January 31, 1998, will dispose of the high-level radioactive waste or spent nuclear fuel involved as provided in this subtitle."

Please provide the Committee with a memorandum from the General Counsel analyzing

(1) the legal obligations of the Department under this provision of law, and

(2) the Department's authority to take title to high-level radioactive waste or spent nuclear fuel under this or other provisions of the Act,

in the event that a repository has not commenced operation by January 31, 1998.

This memorandum should also summarize the relevant provisions of the contract the Department has been using to implement the requirements of section 302 of the Act and discuss (1) the Department's obligations under this contract in the event that a repository has not commenced operation by January 31, 1998, and (2) the remedies available to owners or generators of high-level radioactive waste or spent nuclear fuel in the event that the Department does not take title to the fuel or waste covered by this contract by that date.

Department of Energy
Washington, D.C. 20585

May 30, 1984

Honorable J. Bennett Johnston
Ranking Minority Member
Committee on Energy and
  Natural Resources
United States Senate
Washington, D. C. 20510

Dear Senator Johnston:

Your letter to Secretary Hodel of April 23, 1984, sought responses from the Department to five sets of questions relating to implementation of the Nuclear Waste Policy Act of 1982. Please accept my apology for the delay in responding to your second set of questions, which requested the views of this office on the legal obligations imposed by section 302(a)(5) of the Act in the event a repository has not commenced operation by the January 31, 1998 date contained in paragraph (B) of that section.

The Nuclear Waste Policy Act of 1982 was passed with the presumption that a repository would be operational by January 31, 1998. The Department fully intends to meet this Congressional objective and is currently in the process of taking the steps necessary to ensure that we fulfill all of our corresponding legal obligations under the Act. Therefore, the program which has been developed by the Department to fulfill the requirements of the Act is designed "to assure acceptance of waste for disposal by January 31, 1998." */

We believe the intent of the Congress when formulating the Act was directed toward commencing disposal operations by 1998. The Department is totally committed to achieving this objective. In light of this commitment, we are not now in a position to analyze in any meaningful way the legal consequences raised by your question as the Act was premised upon the existence of an operational repository by the January 31, 1998 date.

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*/ U.S. Department of Energy, Office of Civilian Waste Management, Mission Plan for the Civilian Radioactive Waste Management Program, Volume I at 1-1 (Draft, April, 1984).

It is also important to note that Section 302(a)(5) clearly contemplates that the Department, not later than January 31, 1998, will accept for disposal, on an orderly schedule, high level radioactive waste and spent nuclear fuel. To implement this section, the Department will incorporate into its contracts provisions which specify the minimum amount of materials which the Department will be obligated to accept. We believe this approach is the best vehicle to ensure that utilities will be able to plan for future waste disposal with certainty.

I hope this information will be helpful to you. If I may be of any additional assistance, please do not hesitate to call.

Sincerely,

Garrish

Theodore J. Garrish
General Counsel

cc: Honorable James A. McClure

QUESTIONS FROM CHAIRMAN JOHNSTON

Capacity at Yucca Mountain

QUESTION 3: We understand from a briefing presented by Nevada state officials that the Yucca Mountain site is bounded by a series of faults that appear to limit the size of the repository to about 70,000 metric tons of spent fuel. Is this true? If the Yucca Mountain site is chosen for the first repository won't a second repository be a physical necessity because of the capacities limitation at Yucca Mountain? Explain. What are the capacities of the other sites (Washington, Texas, Mississippi and Utah)?

ANSWER: Some excess area has always been factored into conceptual repository designs to accommodate such geological features as fault zones or lateral variation in host rock properties. A requirement to increase the capacity of a repository at Yucca Mountain would involve expanding the contiguous underground facility toward the east, north, or west as indicated in EA Figure 3-8 (attached). These and other alternatives for expansion were analyzed in recent work that is partially reported in the SCP Conceptual Design effort. As discussed in the EA, additional studies would need to be conducted to determine the suitability of these other areas for waste emplacement. Therefore, the potential exists that the Yucca Mountain site would not be physically limited to 70,000 metric tons (if there were no 70,000 metric ton limit per the Act). The other sites also have capacities that would allow

ANSWER 3: (cont'd)

emplacement of a minimum of 70,000 metric tons. Studies would need to be conducted to ascertain the maximum capacity of each of the sites.

Indeed, all the sites nominated (Nevada, Washington, Texas, Mississippi and Utah) have a potential design capacity of 70,000 metric tons of spent fuel. The sites are potentially capable of additional expansion beyond 70,000 metric tons and would be limited by the results of site characterization and property boundaries.

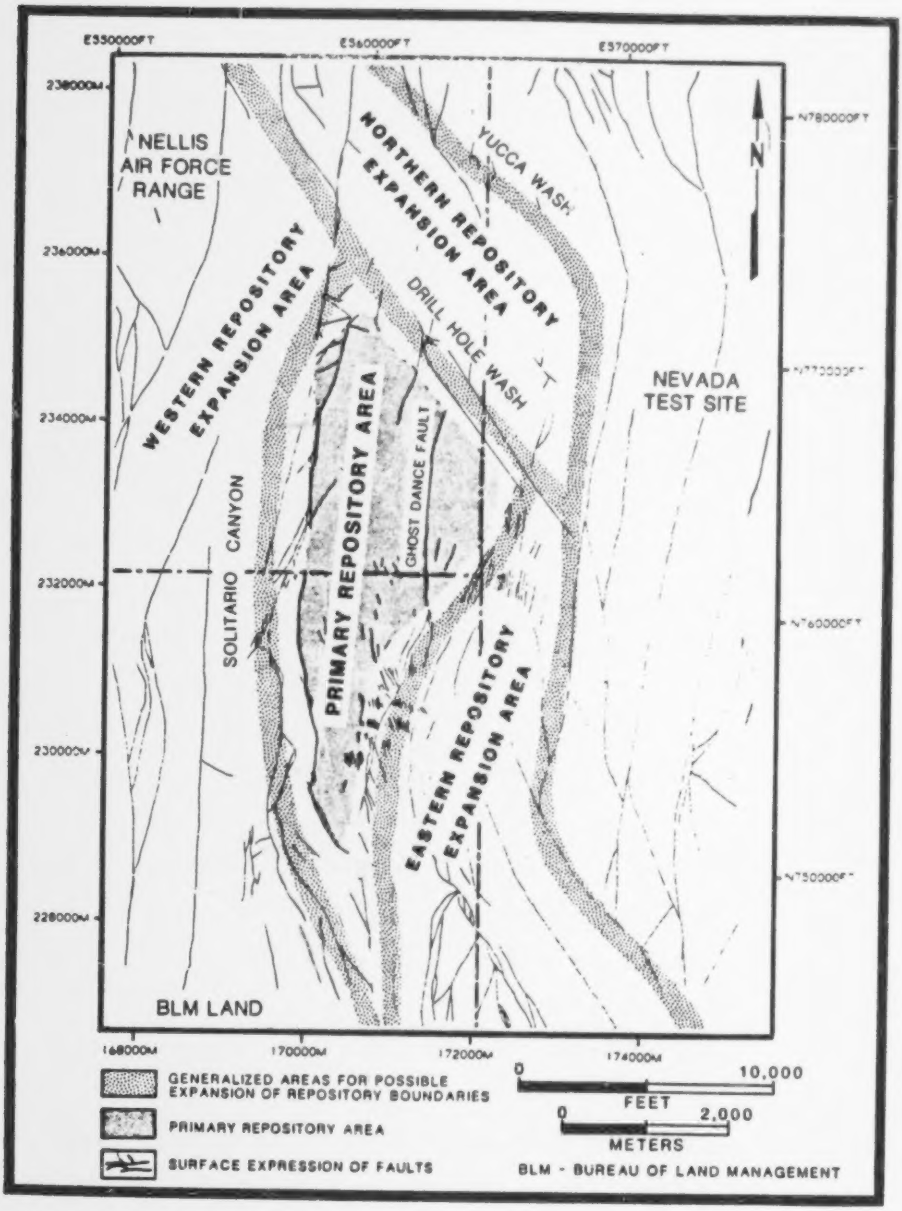

Figure 3-8. Generalized outlines of the primary repository and possible expansion areas. Modified from Mansure and Ortiz (1984).

QUESTIONS FROM CHAIRMAN JOHNSTON

Impact Aid for Deaf Smith and Hereford Counties

Question 4: There was a conversation at the hearing about the socioeconomic impact of site characterization at the Deaf Smith site from the Department's plans to come to employ approximately 800 people within a few months in an area that currently has only a slightly larger total population. Will any form of impact aid be provided to the local governments to address these impacts? How much? When? In what form?

You should be aware that when we talked to them at the hearing, the local officials who testified at the hearing were unaware of any definite plans to provide aid to mitigate this impact.

Answer: At this time, based on all available information and analyses, the Department of Energy has not been able to identify any significant adverse impacts that are likely to result from current projections of inmigration of DOE and DOE contractor workers to the Texas Panhandle during site characterization. The Department does recognize that there is some uncertainty associated with any projection, and therefore, DOE will be monitoring the projected and actual inmigration numbers and the capabilities of local communities to accommodate various levels of inmigration. This monitoring will enable DOE to institute mitigative measures as appropriate to avoid adverse impacts before they occur. Such a DOE monitoring program will aid DOE in meeting the objective of Section 113(a) of the Nuclear Waste Policy Act of 1982 (the Act), which states that DOE is to conduct its site characterization activities

ANSWER 4: (cont'd)

in a mannner that minimizes, to the maximum extent practicable, any significant adverse socioeconomic or environmental impacts.

It is important to note that Section 113(a) of the Act relates to mitigation through modifications in DOE's site characterization activities. The Act, in Sections 116(c)(1)(B) and 118(b)(2)(A), specifies and limits the scope of financial assistance available to States and Indian Tribes during site characterization, and these sections do not describe impact mitigation funding during site characterization. Thus, any mitigation taken during site characterization by DOE will be through changes in how DOE conducts its site characterization activities.

According to the Act, DOE is authorized to provide during site characterization the following types of assistance: (1) Grants for purposes related to State and Indian Tribe participation in the civilian radioactive waste program. These purposes do not include impact mitigation assistance during site characterization; and (2) Payments-Equal-To-Taxes, which can be used by an eligible State, unit of

ANSWER 4: (cont'd)

general local government, or Indian Tribe for any purpose in accordance with applicable State and local laws, including mitigating any impacts that may occur as a result of site characterization.

QUESTIONS FROM CHAIRMAN JOHNSTON

Relationships with Local Governments

QUESTION 5: Please provide the Committee with your plan for interaction with local authorities with jurisdiction over the site of a repository. Provide the same for the case of a monitored retrievable storage facility.

What types of financial assistance, technical assistance, impact aid, or other assistance or compensation does DOE plan to provide to local governments with jurisdiction over the site and local governments adjacent to the site? When would this assistance or aid be provided?

What aid or assistance would be provided during the site characterization process at a repository site?

Provide an analysis of the authority available to provide impact aid to local governments. Are you using all the authority available to you? If not, why not?

What problems do you see with the authority you have to interact with and provide assistance or aid to local governments? What provisions of the Nuclear Waste Policy Act are responsible for these problems?

ANSWER: DOE, in coordination with the State governments, plans to interact with local authorities with jurisdiction over the site of a repository, on major program studies and milestones, including scoping for the Environmental Impact Statement, developing and implementing site characterization Socioeconomic and Environmental Monitoring and Mitigation Plans, the Payments-Equal-To-Taxes program, and land acquisition plans. DOE is also developing, in consultation with State and local parties, Facility-Specific Outreach and Participation Plans that will define institutional interactions with State and local parties at each site.

ANSWER 5: (cont'd)

In the case of a monitored retrievable storage facility (MRS), the MRS proposal provides for the establishment of an MRS Steering Committee. State and local governments would have representatives of their choosing as members of the Steering Committee. The Committee will provide a mechanism for State and local involvement in all aspects of the implementation of the MRS project and for obtaining input, including recommendations and evaluations, regarding the design, construction, operation, and decommissioning of the proposed MRS facility. The Steering Committee would provide oversight, guidance, conduct performance evaluations, and recommend corrective actions. The Steering Committee will have the authority to convene and maintain specialized subcommittees to review or provide oversight on particular areas of interest or concern. As proposed, there will be a subcommittee on environment, safety, and health, a subcommittee on transportation, a subcommittee on public information, and a subcommittee on financial matters. Under section 141(f), upon receipt by the Secretary of authorization to construct an MRS, the Secretary is required to commence making annual impact aid payments to appropriate units of general local government.

ANSWER 5: (cont'd)

In accordance with sections 116(c) and 118(b) of the Nuclear Waste Policy Act of 1982 (the Act), DOE is authorized to provide the following types of financial and technical assistance, impact aid, and other compensation to certain States and affected Indian Tribes.

1) Grants to States and affected Indian Tribes. These grants, which are for certain purposes related to State and Indian Tribe participation in the repository program, are currently being provided to the States and affected Indian Tribes, and will continue through repository construction and operation. These grant provisions apply only to States and affected Indian Tribes. Any grant to a local government would have to be accomplished through the State, and it would be the State's decision to pass grant funding down to the local governments.

2) Payments-Equal-To-Taxes to eligible States, units of general local government or Indian Tribes. These payments, which are for any purpose in accordance with applicable State and local laws, are to be provided beginning with site characterization

ANSWER 5 (cont'd)

and continuing until such time as all activities, development and operation are terminated at a site.

3) Financial and technical assistance to States and affected Indian Tribes. This assistance, which will be based on impact assistance requests from the States and affected Indian Tribes, is to begin after the initiation of construction activities of the repository at the selected site. Since this assistance is to be provided to the State, any assistance to local governments would have to be through the State, and the State would need to address the local governments' concerns about impacts in the State request for impact assistance.

Except for the special section 141(f) authorization previously discussed for the MRS facility, the Department does not have authority to provide impact assistance directly to local governments. DOE has encouraged Congress to consider the need to provide authority for direct participation by local governments as well as additional flexibility in the definition of the units of local government to which the DOE would be allowed to make payments under the Act's provisions for payments-equal-to-taxes. (DOE is currently restrained from making

ANSWER 5 (cont'd)

such payments to special units of local government.) As described above, sections 116(c) and 118(b) of the Act provide the authority for financial assistance to States and affected Indian Tribes. It would be expected that the States would address the concerns of the local governments with regard to financial assistance for local participation and impact aid, if authorized.

QUESTIONS FROM CHAIRMAN JOHNSTON

QUESTION 6: What projections of spent nuclear fuel production does DOE use now for planning purposes? Show the annually produced and cumulative amounts through 2030 for the principal alternative projections available to you. How many new nuclear power plants not now planned do you assume will contribute to this inventory of spent fuel?

How do the assumptions in the principal alternative projections affect the adequacy of the one-mil-per-kilowatt-hour fee to fund the program planned with and without the current proposed mission plan amendments?

How do these assumptions affect the calculation of defense programs payments to the Nuclear Waste Fund under each of the proposed methods of computing these payments?

ANSWER: The Department utilizes as its reference case for spent nuclear fuel (SNF) discharge projections the Energy Information Administration's (EIA) "upper reference case" (formerly called the "mid-case"). Other principal alternative cases are the EIA "optimistic case," "lower reference case," and "no new orders case." Projections for all four cases are attached. However, the Office of Civilian Radioactive Waste Management does not use the "optimistic case" in its planning. It should be noted that the tables project SNF discharges through the year 2020. EIA projections do not currently extend beyond 2020.

ANSWER 6: (con't)

The number of nuclear plants not now planned which are assumed to contribute to the SNF inventory are estimated based on the EIA forecast of the nuclear share of total electricity needed through the year 2020. In the "upper reference case," 140 new reactors are assumed. In the "lower reference case," 62 new reactors are assumed. Note that reactors coming online between 2018 and 2020 may or may not contribute to the SNF inventory depending on their length of startup generation cycle.

As is the case with most major construction efforts, there are significant fixed program costs and, therefore, economies of scale to be gained by spreading those costs over a larger base. Since they are associated with declining electricity generation projections, declining SNF discharge projections tend to make the one-mil-per-kilowatthour fee adequate for a fewer number of program cost scenarios. However, the effect of the revised schedules contained in the draft Mission Plan Amendment is to increase the number

ANSWER 6: (cont'd)

of scenarios in which the current fee would be adequate. This is due to the fact that increases in estimated costs as a result of delaying major expenditures are more than offset by estimated increases in Nuclear Waste Fund investment earnings.

The methodology for calculating fees for the disposal of defense waste proposed in the Notice of Inquiry published in the Federal Register on December 2, 1986, was based upon the relative quantities of commercial and defense waste to be emplaced in the repositories. Under this methodology, if defense waste quantities were to remain unchanged, declining commercial waste quantities would have the effect of increasing defense waste disposal fees since defense waste would occupy a larger proportion of the disposal facilities.

Projections of Total U.S. Spent Fuel Discharges (Thousand Metric Tons of Initial Heavy Metal)

Year	No New Orders Case	Lower Reference Case	Upper Reference Case	Optimistic Case
1985[1]	12.4	12.4	12.4	12.4
1986	13.8	13.8	13.8	13.8
1987	15.3	15.3	15.3	15.3
1988	17.0	17.0	17.1	17.1
1989	18.9	18.9	19.2	19.2
1990	20.9	20.9	21.2	21.3
1991	23.0	23.0	23.2	23.4
1992	25.1	25.1	25.4	25.6
1993	27.2	27.2	27.4	27.7
1994	29.2	29.2	29.4	29.7
1995	31.2	31.2	31.5	31.8
1996	33.2	33.2	33.5	33.9
1997	35.0	35.0	35.5	35.9
1998	36.9	36.9	37.5	38.0
1999	38.9	38.9	39.5	40.0
2000	40.8	40.8	41.6	42.0
2001	42.7	42.7	43.6	44.1
2002	44.6	44.6	45.6	46.2
2003	46.6	46.6	47.8	48.5
2004	48.6	48.6	50.1	51.1
2005	50.5	50.5	52.4	53.7
2006	52.5	52.5	55.0	56.7
2007	54.6	54.6	57.7	60.2
2008	56.5	56.5	60.3	63.5
2009	58.6	58.7	63.4	67.4
2010	60.9	61.1	66.6	71.8
2011	63.1	63.4	69.9	76.1
2012	65.3	65.9	73.5	80.9
2013	67.6	68.5	77.2	86.3
2014	70.2	71.5	81.4	91.9
2015	72.3	74.3	85.6	97.7
2016	74.0	76.8	89.6	103.9
2017	75.7	79.5	93.7	110.3
2018	77.0	81.8	97.8	116.6
2019	78.1	84.1	101.8	123.0
2020	79.3	86.8	106.0	130.3

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[1] Preliminary data collected on Form RW-859, "Nuclear Fuel Data," indicate that 12.4 thousand metric tons of initial heavy metal have been discharged through 1985.

Projections of Annual U.S. Spent Fuel Discharges (Thousand Metric Tons of Initial Heavy Metal)

Year	No New Orders Case	Lower Reference Case	Upper Reference Case	Optimistic Case
1985	1.2	1.2	1.2	1.2
1986	1.4	1.4	1.4	1.4
1987	1.5	1.5	1.5	1.5
1988	1.7	1.7	1.8	1.8
1989	1.9	1.9	2.1	2.1
1990	2.0	2.0	2.0	2.1
1991	2.1	2.1	2.0	2.1
1992	2.1	2.1	2.2	2.2
1993	2.1	2.1	2.0	2.1
1994	2.0	2.0	2.0	2.0
1995	2.0	2.0	2.1	2.1
1996	2.0	2.0	2.0	2.1
1997	1.8	1.8	2.0	2.0
1998	1.9	1.9	2.0	2.1
1999	2.0	2.0	2.0	2.0
2000	1.9	1.9	2.1	2.0
2001	1.9	1.9	2.0	2.1
2002	1.9	1.9	2.0	2.1
2003	2.0	2.0	2.2	2.3
2004	2.0	2.0	2.3	2.6
2005	1.9	1.9	2.3	2.8
2006	2.0	2.0	2.6	3.0
2007	2.1	2.1	2.7	3.5
2008	1.9	1.9	2.8	3.3
2009	2.1	2.2	3.1	3.9
2010	2.3	2.4	3.2	4.4
2011	2.2	2.3	3.3	4.3
2012	2.2	2.5	3.6	4.8
2013	2.3	2.6	3.7	5.4
2014	2.6	3.0	4.2	5.6
2015	2.1	2.8	4.2	5.8
2016	1.7	2.5	4.0	6.2
2017	1.7	2.7	4.1	6.4
2018	1.3	2.3	4.1	6.3
2019	1.1	2.3	4.0	6.4
2020	1.2	2.7	4.2	7.3

Note: Projected values have been smoothed using a 3-year moving average technique.

QUESTIONS FROM CHAIRMAN JOHNSTON

QUESTION 7: State Technical Concerns

a. State officials have made the very serious charge that there are major potentially disqualifying flaws at each of the three candidate sites that the Department has either dismissed with insufficient scientific evaluation or chosen to ignore completely. They claim that the Department maximizes its collection of that data that will prove positive about the sites, while minimizing the amount of data it collects that may yield negative information about the sites. The states charge that the Department is doing this to carry out the process for as long as possible before dropping any sites from consideration.

-- Please respond to these charges.

ANSWER: While DOE appreciates that State officials may disagree with the findings concerning the presence or absence of potentially disqualifying flaws at each of the three candidate sites, DOE must strongly disagree with the above assertion. Data gathering efforts to date have focused on resolving the technical issues at the sites, to the extent that has been possible with the surface-based testing programs. Such disagreements are inevitable in managing a large, complex, and controversial program. In addition, we note that rigorous application of several of the disqualifying conditions, for example, the condition on groundwater travel time, require data that can only be collected during site characterization. Judging

ANSWER 7a: (cont'd)

by the examples cited by the State officials and discussed in more detail below, it is these types of disqualifying conditions that are of the most concern. Finally, we note that the Nuclear Regulatory Commission (NRC) agreed with the DOE evaluations on the disqualifying conditions in the sense that there is insufficient evidence at this stage of the siting process to disqualify any of the five nominated sites.

DOE also disagrees that there is any intent to carry sites as long as possible before dropping them. We would like to mention two points in support of this position. First, the philosphy that DOE used in specifying many of the 17 disqualifying conditions in the DOE siting guidelines, which were developed through consultation with State officials, public comment, and NRC concurrence, was that the disqualifying conditions should be able to be applied without extensive data gathering or complex analysis, e.g., disqualifying conditions on population density and distribution. DOE developed such disqualifying conditions with the obvious intent of using them in the site-selection process to eliminate sites early when practical, not to

ANSWER 7a: (cont'd)

carry them on forever. The fact that none of the nominated (5) sites are disqualified is a testament, in part, to a screening process that has been ongoing for nearly 10 years, using criteria that have been developed by DOE and its predecessor agencies, the National Academy of Sciences, the International Atomic Energy Agency, the Nuclear Regulatory Commission, and the Environmental Protection Agency.

Second, DOE is taking steps in the design of its site characterization programs to evaluate where appropriate the presence or absence of disqualifying conditions as early as possible. For example, the geohydrology testing program for the Hanford site to be carried out before construction of the exploratory shafts has been structured in part to provide an early indication of the presence of any geohydrologic-related disqualifying conditions. DOE developed evaluation criteria for this purpose. DOE discussed the planned geohydrologic program with the States, Indian Tribes, and the NRC at a meeting in Richland, Washington, on April 7-9, 1987.

QUESTIONS FROM CHAIRMAN JOHNSTON

QUESTION 7: State Technical Concerns

b. Does the Department know of any potentially negative data about a site that it has systematically ignored?

-- For example, for the Nevada site, has the Department ignored data concerning active fault movement, hydrothermal activity, the possibility of mineral resources, or groundwater travel time?

-- For the Texas site, has the Department ignored data concerning the effect of salt creep?

-- For the Washington site, has the Department been overly optimistic in its use of data or by ignorance of data concerning groundwater travel time or tectonic stability?

ANSWER: DOE has not ignored any potentially negative data about any of the candidate sites. The DOE, its contractors, and supporting organizations strive for technical excellence and free information exchange through high professional standards, including document review, publications, meeting participation, peer review, workshops, field trips, and informal exchanges. Published findings generated by DOE are subjected to intense public, State, Indian Tribes, and regulatory scrutiny. We address below the issues cited above for each of the candidate sites only very briefly. In almost all cases, the issues are long-standing and have been fully addressed in many technical documents to

ANSWER 7b: (cont'd)

the extent possible before site characterization. DOE would be happy to provide additional detail on all of these issues.

Yucca Mountain Site - Studies of past and future fault movements in the vicinity of the Yucca Mountain site were discussed extensively in the Environmental Assessment (EA) (see, for example, sections 6.3.1.7 and 6.3.3.4 of Volume II of the EA). A number of workshops have been held and will continue to be held to review ground motion and related issues of the Yucca Mountain site. Certainly the issue has not been ignored, and it is recognized to be one of the most important issues for judging the suitability of the site. We summarize below the pertinent findings from the EA, addressing both the preclosure and postclosure time periods.

Small magnitude earthquakes in the surrounding region of the Yucca Mountain site can be expected to affect design of the surface facilities and possibly the underground facilities. Such activity is likely to produce ground motion that is presently judged to be within the design limits likely to be applied to nuclear repositories.

ANSWER 7b: (cont'd)

Special engineering measures will be taken to minimize the effects of shaking and faulting displacement on repository operations prior to permanent closure. Extensive data on seismic design of nuclear and non-nuclear structures, and on actual responses of such structures to different types of seismic loading are available. Additional site-specific information for seismic design of surface and underground repository facilities is required.

With regard to the postclosure period, the geologic record of faulting during the last 1.8 million years or so suggests that Yucca Mountain could experience seismicity and faulting in the future. There is, however, no clear evidence that a major earthquake is likely to occur at or near Yucca Mountain. In any event, the consequence of fault movement on waste isolation in this geologic environment, i.e., the unsaturated zone, is expected to be minimal because little groundwater is expected to be available for dissolution and transport of the waste and because of expected long groundwater travel times. Notwithstanding, special care would

ANSWER 7b: (cont'd)

be taken during waste emplacement to consider consequences of emplacement in or near recognized fault zones. Further investigation of the nature of fault movement that can be expected and of its consequences are planned during site characterization.

The issue concerning the potential for hydrothermal activity at the Yucca Mountain site is relatively recent, but clearly has not been ignored. DOE has worked continually to resolve the technical issues associated with the specific calcite-silica deposits that initiated speculation about hydrothermal processes, but at this point, the issues remain largely unresolved. The available data pertaining to the issue have been discussed with representatives from interested State and Federal agencies during three workshops in 1985 and 1986 and in numerous field trips conducted in 1986 and 1987. Many additional studies are planned during site characterization to assess the potential for hydrothermal activity and its possible effects on waste package and repository performance.

ANSWER 7b: (cont'd)

Extensive discussions concerning the issues of natural resources at the Yucca Mountain site are contained in the EA (see, for example, section 6.3.1.9, pgs. 6-281 through 6-292, Vol. II of EA). We very briefly summarize that discussion.

Present evidence based on geophysical surveys, geologic surface mapping, and numerous drillholes in and near the Yucca Mountain site suggests that the site would not be a likely target for future exploration for precious metals (such as gold and silver) or for energy resources such as geothermal, hydrocarbon, or uranium resources. Although the site does contain potable groundwater, future drilling for groundwater at the site appears unlikely for several reasons, including poor agricultural characteristics of the soils and the fact that drilling and extraction would be more economical in surrounding flat areas. Further studies are planned during site characterization to provide additional information on the distribution and importance of natural resources.

Finally, with regard to ground-water travel time estimates, various lines of field and laboratory

ANSWER 7b: (cont'd)

evidence were presented and analyzed in the EA (see, for example, section 6.3.1.1 of Volume II of EA) that suggest travel times greater than 10,000 years. Because of limited data, several assumptions were made in the EA for purposes of calculating groundwater travel times that require verification. The assumptions are believed to be conservative and are consistent with all data available at the time of publication of the EA. DOE knows of no information that would obviate the original assumptions in the EA. As with all the other issues discussed thus far, site characterization is required to make a definitive finding on the issue.

Deaf Smith County Site - DOE has not ignored data concerning the effect of salt creep (see, for example, pg. C.8-6 of Vol. III of the EA). The effects of creep must be considered in two ways: the first is the closure of the hole in which the waste canister is placed, and the second is the closure of the rooms and passageways that permit access to the disposal holes. Engineering methods, such as controlling the temperature of the salt or

ANSWER 7b: (cont'd)

use of mechanical supports, can be employed to reduce the rate of closure, estimated to be about 20 cm/year at the site. Each of these methods, along with numerous others, has been considered, and specific practical approaches for maintaining retrievability are being defined. The difficulty and cost of retrievability will be determined in part by the length of time during which it is required.

Clearly, DOE recognizes that salt creep is an important issue that will require intense scientific investigation involving laboratory, field, and numerical modelling studies. DOE is further aware of ongoing creep-related field experiments being conducted at the Waste Isolation Pilot Plant, at Asse in the Federal Republic of Germany, and in other localities. DOE is aware of the potential for creep-related disturbances to interbeds and aquifers above the repository horizon at Deaf Smith to add additional complexities to the problem. A detailed site investigation program is being planned to gain a thorough understanding of the deformation mechanisms of salt and their

ANSWER 7b: (cont'd)

dependence on stress and temperature, and to address retrievability issues. This planned program will be documented in the Site Characterization Plan for the Deaf Smith site and associated more-detailed study plans, and will be published by DOE for review and comment by the NRC and other interested parties.

Hanford Site - Issues concerning ground-water travel times and tectonic stability are discussed at length in the EA (see, for example, sections 6.3.1.1.1.11, 6.3.1.7, 2.3.12, and 6.3.3.4). There is a high likelihood that ground-water travel times to the accessible environment will exceed 10,000 years along flow paths of likely radionuclide travel. The ground-water travel-time models explicitly estimate the uncertainty in the predicted travel times. An intense data-collection program is planned to help reduce the uncertainty in predictions of ground-water travel time.

The nature and rate of fault movement (the principal concern in tectonics) or other ground motion at the Hanford site are not expected to result in a loss of

ANSWER 7b: (cont'd)

waste isolation. Similarly, there appears to be a low probability that ground motion could adversely affect a repository during the preclosure period. The low probability of ground motion is based on the following evidence: (1) seismicity of the Columbia Plateau is low to moderate; (2) the recurrence rate of moderate-size earthquakes is long; (3) the candidate site at Hanford was sited away from areas of major faulting; and (4) the potential for igneous activity is low. Additional geologic studies are planned during site characterization to further address tectonics issues.

Again, DOE recognizes that despite its best efforts to fairly and accurately represent its scientific judgments about such issues as ground-water travel time and tectonic stability, these issues are still the subjects of much valuable and constructive debate. We believe that there is no basis whatsoever for charges that the issues have been ignored, as demonstrated by the numerous references given above. Current uncertainties leave room for reasonable and knowledgeable experts to disagree. Until site-characterization studies are complete, we

ANSWER 7b: (cont'd)

simply cannot be more definitive about the issues. The regulatory process is designed to ensure that no stone is left unturned, so to speak, with regard to these issues. The testing program to be described in forthcoming Site Characterization Plans will be a first step toward resolving the issues.

QUESTIONS FROM CHAIRMAN JOHNSTON

QUESTION 7: State Technical Concerns

c. The state of Nevada has told us that the Ghost Dance Fault at Yucca Mountain is potentially a limiting fault, which could limit the size of a repository at that site.

-- Is it true that this fault could limit the size, and therefore capacity, of a repository to 70,000 metric tons?

ANSWER: The Ghost Dance fault is a north-south steeply dipping normal fault that transects the eastern part of the site area. It is a relatively minor fault with a maximum dip-slip (vertical) displacement of about 25 meters. The context of this fault relative to the stratigraphy and structure of the site is given in Sections 3.2.1 and 3.2.2 of the EA, and in particular on page 3-15. The impact of a fault within the repository areas is also described in the EA (see Section 6.3.1.7.3, pp 6-262 and 6-263) and in the response to Question 3, supra. Plans for acquiring the needed data for evaluating repository design and performance are fully developed in the Site Characterization Plan.

Investigations of the Ghost Dance fault have always been an integral part of site characterization plans, without respect to the capacity requirements of the repository. Some excess area has always been

ANSWER 7c: (cont'd)

factored into conceptual repository designs to accommodate such geological features as fault zones or lateral variation in the spatial distribution of important parameters. A requirement to increase the capacity of the repository would involve expanding the contiguous underground facility toward the east, north, or west as indicated in the EA. These and other alternatives for expansion were analyzed in recent work that is partially reported in the Conceptual Design Report, which supports the SCP. This is a conservative analysis that is based on preliminary knowledge of the surrounding area, and shows that the site has a potential for a capacity of over 70,000 MTU. Final capacity capabilities can only be determined by at-depth studies planned during site characterization.

QUESTIONS FROM CHAIRMAN JOHNSTON

QUESTION 7: State Technical Concerns

d. A major concern of the States is that the Department does not work with them and is never willing to concede any points until they are forced. By the States' description, the Department is like a hen-pecked husband who responds best when he is beat upon.

-- How would the Department respond to this charge?

-- How can the Department improve this problem, or this perception, on the part of the States?

ANSWER: The most complete response is contained in a document entitled "Report by the U.S. Secretary of Energy on Efforts to Comply with Consultation and Cooperation Provisions of the Nuclear Waste Policy Act of 1982," to be submitted to Congress in June 1987. In summary, the record shows that the Department has regularly sought State and Tribal input to policy formulation and has responded to it, often modifying proposed policies to meet State and Tribal needs and interests. DOE seeks to improve its ability to anticipate issues of concern to States and Tribes.

The Department will continue to seek ways to interact more effectively with the States and Indian Tribes. Since the objectives of the parties differ, agreements in all areas are probably not feasible, but improved understanding of differing positions can be achieved and will be sought. The

ANSWER 7d: (cont'd)

Department continues to believe that negotiation of Consultation and Cooperation Agreements, as called for in the Act, is the single most effective action States and Indian Tribes can take to further clarify their rights and role in the program.

QUESTIONS FROM SENATOR MCCLURE

QUESTION 1:	In light of the delays in the first repository program, is there any merit in considering the authorization of more than one MRS?
ANSWER:	The national consensus for timely geologic disposal was achieved after years of research and debate through the enactment of the Nuclear Waste Policy Act of 1982, which provided clear direction for the waste management program. The Department continues to have complete confidence that the program can implement a waste management system that will result in timely repository operation. To help achieve this, the Department has proposed an MRS as an integral component of the waste management system and further proposed that the MRS be restricted in capacity and not operated until construction of a repository has been approved by the NRC. These specific measures have been recommended to assure that the construction of an MRS does not detract from the national resolve to safely and permanently isolate spent fuel and high-level waste in geologic repositories. As a result, the Department believes that consideration of more than one MRS is not warranted.

QUESTIONS FROM SENATOR MCCLURE

QUESTION 2: a) In light of the apparent negative reaction by Tennessee to the prospects of siting an MRS in that State, would it make sense to authorize the MRS without tying it to a specific State?

b) Has DOE considered other sites in other States for the MRS?

ANSWER: a) The reaction of the State of Tennessee to the prospect of siting an MRS in their State has not been all negative. Some parties who studied the materials developed by the Department on the MRS facility agreed that the facility can be constructed and operated safely. The task force appointed by the City of Oak Ridge and by Roane County found the facility acceptable provided that certain conditions be met. The Department believes it has responded to those conditions in the proposal to Congress.

As the Department's MRS studies have indicated, the MRS is an engineered facility that does not rely on geologic features to assure safe storage of the radioactive materials and could most likely be sited safely in virtually any State in the Nation. Because of this, the Department searched for sites that further improve the overall waste management system and could lead to the timely, cost-effective deployment of the MRS. This led to the investigation of the sites listed below and the identification of the proposed sites.

ANSWER 2: (cont'd)

Congress in the NWPA reserved the actual selection of the MRS site to itself. The Department believes that there is sufficient information available to Congress to make that site selection, and recommends a site-specific authorization. Authorizing an MRS without tying it to a specific site would make little sense at this point, unless there was high confidence that an alternative site could be selected that would not carry with it some "apparent negative reaction."

b) The Department considered eleven sites during the site screening process documented in the site screening report (DOE/RW-0023). The sites considered were as follows:

Site/State

1) Alan R. Barton Nuclear Power Plant, Alabama
2) Barnwell Reprocessing, South Carolina
3) Cherokee Nuclear Station, South Carolina
4) Clinch River Breeder Reactor, Tennessee
5) Hartsville Nuclear Plant, Tennessee
6) Oak Ridge Reservation, Tennessee
7) Paducah, Kentucky
8) Perkins Nuclear Station, North Carolina
9) Phipps Bend Nuclear Plant, Tennessee
10) Savannah River Plant, South Carolina
11) Yellow Creek Nuclear Plant, Mississippi

QUESTIONS FROM SENATOR MCCLURE

MRS

QUESTION 3: Would the use of an MRS for longer-term (say, 30-40 years) cooling of the spent fuel make engineering, site, and licensing of a permanent repository an easier task?

ANSWER: Spent fuel that is aged significantly longer than 5 to 10 years could result in reduced thermal design constraints on the repository and waste package. In particular, the amount of spent fuel that can be disposed of in a unit area of underground repository space can be increased. However, beyond 10 to 20 years, additional heat and radiation dissipation is minimal. Based on the oldest-fuel-first approach for acceptance of spent fuel from the utilities and a repository operations start-up date of 2003 (draft Mission Plan Amendment), the age of spent fuel to be received at a repository ranges from a minimim of about 10 years up to about 35 years. Thus, DOE currently feels there is not much incentive from an overall systems perspective to use the MRS for additional aging of spent fuel.

QUESTIONS FROM SENATOR MCCLURE

QUESTION 1: Compare and contrast the activities that DOE will include under "site characterization" as compared to that being planned in Sweden and France. Why do our activities cost so much more?

ANSWER: With the limited information currently available, it would be very difficult, and potentially misleading, to attempt to compare the Department's site characterization activities and costs with those of other countries at this time. Preliminary indications are that in some countries the term "site characterization" may be used to describe a very narrowly defined set of activities focused on investigating a single disposal site. In others, such as the United States, site characterization encompasses a wide range of activities, including detailed technical investigations of three potential sites for a first repository, extensive interactions with the EPA, the NRC, and States and affected Tribes, and preparation of a License Application for submittal to the NRC.

The Department has initiated a joint undertaking between representatives of several countries to discuss waste disposal program cost estimates. A major focus of this undertaking is to compare the activities, and associated costs, included under site characterization as defined in each country.

QUESTIONS FROM SENATOR MCCLURE

QUESTION 2: On a unit volume basis, how does our disposal program compare in cost to that in Sweden?

ANSWER: As indicated in the response to the previous question, it is very difficult to make accurate comparisons with the limited information currently available. The Department expects to be in a better position to more accurately compare the costs of the two programs subsequent to analysis of data from the joint undertaking referenced in the response to the previous question.

QUESTIONS FROM SENATOR MCCLURE

Nuclear Waste Program

QUESTION 3: Does DOE have plans to provide multiple layers of engineered barriers (such as those suggested by Alvin Weinberg in his prepared testimony) to increase the integrity of the geological disposal site? Which types of engineered barriers are being considered? Which method -- engineered barrier or geological barrier -- is given higher weighting in waste integrity considerations?

ANSWER: Consistent with the NWPA and regulatory requirements, DOE is planning to provide multiple engineered barriers to provide redundancies to ensure waste containment and to control radionuclide release to the accessible environment. Engineered barriers are the man-made components of the system designed to prevent the release of radionuclides from the underground facility and include the waste package, the underground facility, and any shaft and borehole seals. The waste package itself is composed of multiple engineered barriers, including the waste form (spent fuel or borosilicate glass), disposal container (metallic or non-metallic), and packing (tailored host rock and/or clay mixture). However, the DOE Siting Guidelines (10 CFR Part 960), as concurred on by the NRC, make it clear that "engineered barriers cannot constitute a compensating measure for deficiencies in the geologic media during site screening." In addition, the Implementation Guidelines (10 CFR 960.3-1-5)

ANSWER 3: (con't.)

state that "engineered barriers shall not be used to compensate for an inadequate site; mask the innate deficiencies of a site; disguise the strengths and weaknesses of a site and the overall system; and mask differences between sites when they are compared." DOE, in considering sites for a high level radioactive waste repository, would evaluate sites primarily on the basis of the natural barriers. If, however, the sites compared provide equivalent isolation, DOE would then evaluate the sites by considering the total repository system, which would include both the natural and engineered barriers.

QUESTIONS FROM SENATOR MCCLURE

Nuclear Waste Program

QUESTION 4 a: In addition to the input and oversight that will be provided by NRC, EPA, NAS, and states, are there any other scientific bodies or agencies that could provide useful, constructive input into DOE's site characterization process?

b: How formal is the relationship that DOE will have with NRC, EPA, NAS, and the states, concerning their ability to provide input into DOE's site characterization process?

ANSWER a: During the site characterization process, DOE does plan to interact with other bodies or agencies in addition to NRC, EPA, NAS, and the States. These include the affected Indian Tribes, United States Geologic Survey, Bureau of Mines, and the Mine Safety and Health Administration.

b: The DOE relationship with each of these bodies or agencies varies in terms of the expected interactions during site characterization. At a minimum, DOE anticipates many opportunities for constructive dialogue on the site characterization program as it evolves. The extent and formality depend on whether the role is regulatory in nature (e.g., NRC), based on provisions in the NWPA (e.g., States and affected Indian Tribes), or based on interagency protocols or agreements (e.g., BOM), etc.

QUESTIONS FROM SENATOR MCCLURE

Nuclear Waste Program

QUESTION 5: Please discuss the merits of allowing spent fuel to cool for 50 years or more prior to geologic disposal, in terms of heat production and the ability to more easily encapsulate the spent fuel in some type of high-integrity capsules.

ANSWER: Spent fuel that is aged for 50 years will have decreased heat production from radioactive decay and could reduce the design constraints on the repository and the waste package compared to less aged spent fuel. In particular, the amount of spent fuel that can be disposed of in a unit area of underground repository space can be increased. However, beyond 10 to 20 years, additional heat and radiation dissipation is minimal. There is no significant advantage from a waste package fabrication or "encapsulation" standpoint to significantly age spent fuel. Also, the additional cost to the Nuclear Waste Management System to have the capability to age spent fuel for a relatively long period of time must be considered. Based on the oldest-fuel-first approach for acceptance of spent fuel from the utilities and a repository operations start-up date of 2003 (draft Mission Plan Amendment), the age of spent fuel to be received at a repository ranges from a minimum of about 10 years up to about 35 years. Thus, DOE currently feels

ANSWER 5: (cont'd)

there is not much incentive from an overall systems perspective to use the MRS for additional aging of spent fuel.

QUESTION FROM SENATOR HECHT

QUESTION: Please submit a table that indicates how much spent fuel (metric tons) will have aged at least fifty years (been removed from the reactor's core for that period of time) by the year 2003, and how much additional spent fuel will reach age fifty in each successive year thereafter, through the year 2030.

ANSWER: The attached table shows the existing spent fuel discharged since the start of commercial nuclear power generation in 1957. The table provides annual discharges and cumulative inventory by year of discharge and year in which it will have aged 50 years.

Existing Spent Fuel Inventory

Discharge Year	Aged 50 Years	Annual Discharge (Metric Tons of Uranium)	Cumulative Discharge (Metric Tons of Uranium)
1965	2015	4	4
1966	2016	3	7
1967	2017	4	11
1968	2018	0	11
1969	2019	13	24
1970	2020	42	66
1971	2021	91	157
1972	2022	246	403
1973	2023	159	562
1974	2024	446	1,008
1975	2025	518	1,526
1976	2026	714	2,240
1977	2027	838	3,078
1978	2028	1,080	4,158
1979	2029	1,114	5,272
1980	2030	1,244	6,516

QUESTIONS FROM SENATOR HECHT

Question 1: What would be the capital costs associated with the construction of a reprocessing plant for nuclear waste in the United States?

Answer: The estimated capital costs associated with the construction of a reprocessing plant for spent nuclear fuel in the United States from commercial-type light water reactors (LWR's) are in the range of $1.5 to $2.0 billion (in 1987 dollars) for a plant having a capacity of reprocessing about 1,200 metric tons of spent nuclear fuel per year. While reprocessing would eliminate the need of disposing spent fuel directly, the United States would eventually need to dispose of the high-level wastes produced during reprocessing operations. Reprocessing would make the plutonium in the spent fuel available for further use; however, for at least the next decade, there will be limited requirements for plutonium in the United States, either for recycle in LWR's or for use in liquid metal reactors.

QUESTIONS FROM SENATOR HECHT

Question 2:	What would be the annual operating and maintenance costs associated with such a reprocessing plant?
Answer:	The annual operating and maintenance costs of a 1,200 MT reprocessing plant are estimated to be in the range of $80 to $100 million per year.

QUESTION FROM SENATOR HECHT

QUESTION: Please submit a table that indicates how much spent fuel (metric tons) will have aged at least fifty years (been removed from the reactor's core for that period of time) by the year 2003, and how much additional spent fuel will reach age fifty in each successive year thereafter, through the year 2030.

ANSWER: The attached table shows the existing spent fuel discharged since the start of commercial nuclear power generation in 1957. The table provides annual discharges and cumulative inventory by year of discharge and year in which it will have aged 50 years.

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1980	2030	1,244	6,516

POST-HEARING QUESTIONS AND ANSWERS

NUCLEAR REGULATORY COMMISSION

APRIL 28, 1987

QUESTIONS FROM SENATOR JOHNSTON

QUESTION 1. State officials testified that NRC, through the staff comments, is pointing out that DOE's repository search program could very well produce an unlicensable site. Can the NRC staff judge, at this point, what the chances are that a site selected for characterization will be found licensable?

ANSWER.

It is premature for the NRC staff to predict the chances that any particular site selected for site characterization will be found licensable. In its comments on the final Environmental Assessments, the staff did not identify concerns about the suitability of any of the five sites for site characterization. The staff did, however, examine some issues pertaining to the licensability of each site, but these concerns were not unusual considering the limited existing data base. Site characterization will develop the additional data needed to evaluate the validity and significance of any concerns about the licensability of a particular site.

5/22/87 JOHNSTON Q1

QUESTION 2. The state of Nevada has identified five issues that it believes may be disqualifying factors. These factors include faulting and tectonics, groundwater travel time, effects of weapons testing, mineral resources, and volcanic activity.

(A) Does the NRC staff agree that these may be disqualifying factors?

(B) Do we have enough information at this time to make a definitive judgment, or is more information needed?

(C) Is it possible to make a definitive judgment without obtaining site data through characterization?

ANSWER.

Yes, these five factors are among those listed in DOE's Siting Guidelines as factors which could potentially disqualify any site. Existing data for the Yucca Mountain site are limited and any predictions made now about site performance are, by necessity, highly uncertain. A definitive judgement about site licensability is simply not possible without more site specific data obtainable only through characterization. It should be noted that site characterization will consist of many activities, of which sinking an exploratory shaft is but one. It may be possible to obtain conclusive data for some of the disqualifying factors cited (e.g., volcanic activity), by surface-based testing. Completion of the entire site characterization program for a given site would be unnecessary if proof of one or more disqualifying factors is found early in the program.

5/22/87 JOHNSTON Q2

QUESTION 3. The State of Nevada states that many of their concerns are not new. Specifically, Nevada states that the National Academy of Sciences raised concerns first in 1979 related to the seismic and volcanic stability of tuff and the fault characteristics of tuff. The state claims that there is already existing data that should disqualify the Yucca Mountain site.

(A) Has the NRC staff looked at the documentation cited by the State of Nevada and made an independent evaluation?

(B) If not, would this be an appropriate task for the NRC staff to undertake?

ANSWER.

Yes, the NRC staff is aware of the State of Nevada's technical concerns (including those first raised by the National Academy of Sciences) and has independently evaluated the available documentation relevant to those concerns. May of the States's concerns are shared by the NRC staff. However, these concerns can only be resolved by site characterization as existing data are insufficient to disqualify the Yucca Mountain site.

QUESTION 4. With respect to tectonics at the Nevada site, the state says it is reasonable to assume that a large earthquake with accompanying surface faulting could occur and create a significant loss of repository integrity. The state says there may be adequate information on this point to disqualify the site now.

Does the NRC staff agree, or is it necessary to obtain data during site characterization to answer this type of question?

ANSWER.

The NRC staff is aware of the existence of faulting in the Yucca Mountain area and has documented its concerns relative to faulting seismicity in its comments on the final Environmental Assessment for Yucca Mountain. Neither the age and extent of the last movement of faults nor the expected ground acceleration associated with this faulting are sufficiently well known to disqualify the site now. It is necessary to obtain data during site characterization to evaluate the extent and significance of such faulting. After these data are collected, DOE will evaluate whether the faulting poses a threat to repository integrity and, if so, whether the repository can be designed to minimize the threat such that the site will be suitable for repository development.

QUESTION 5. With respect to groundwater travel time at the Nevada site, the state says that conservative estimates suggest the range could be as short as 900 years. Under the DOE's siting guidelines, less than 1,000 years would be a disqualifier.

(A) Does the NRC staff agree, therefore, that the Nevada site should now be disqualified?

ANSWER.

The range of groundwater travel times at the Nevada site is, according to the State of Nevada, from 900 years to 34,000 years. The DOE calculated a range of 9,485 years to 80,235 years (Yucca Mountain final Environmental Assessment, Volume 2, page 6-165). Both ranges illustrate the extent of uncertainty in available calculations of groundwater travel time. The NRC staff detailed a number of sources of these uncertainties in Comment #7 on the Yucca Mountain final Environmental Assessment. In light of the current uncertainties present in any calculation of groundwater travel times at Yucca Mountain, the NRC staff does not agree that the Nevada site should be disqualified at this time.

(B) Isn't it necessary to obtain additional data during site characterization first?

ANSWER.

Yes. The only way to significantly lessen the uncertainties cited above in the groundwater travel time calculations is to obtain additional data during site characterization. These data will help to narrow the range of hydrologic models that need to be considered as well as the ranges of values for parameters that must be used in the calculations.

QUESTION 6. Does the NRC staff believe that DOE has utilized conservative assumptions (worst case) in interpreting technical data at the three sites?

ANSWER.

The DOE has not utilized "worst case" assumptions in interpreting technical data at the three sites. As stated in the DOE Siting Guidelines, on which NRC has concurred, "These assumptions will be realistic but conservative...." (10 CFR 960.3.-1-4-2). In the final Environmental Assessments (EA's), the DOE did, in many cases use realistic but conservative assumptions. On the other hand, the NRC staff's comments on the final EA's pointed out some areas where in the staff's opinion there was a lack of conservatism.

QUESTION 7. Can you explain the differences, if any, between site suitability and licensability?

ANSWER.

In many instances, the terms "site suitability" and "licensability" are used interchangeably. However, licensability is a more precise term that means the NRC regulations applicable to deep geologic disposal of high-level wastes, particularly 10 CFR Part 60, are met.

QUESTION 8. Chairman Zech's response to Senator Johnston's inquiry identified three general areas of concern with DOE's final Environmental Assessments:

(A) DOE did not identify the range of uncertainties associated with the existing data base;

(B) DOE did not identify the range of alternative interpretations and assumptions that can reasonably be supported by existing data;

(C) DOE did not incorporate a reasonable range of uncertainties and alternative interpretations into evaluations and conclusions.

Nevada officials take this to mean that DOE uses data to conclude what it wants to conclude, and ignores data that does not support their view of these sites. Is this your opinion as well?

ANSWER.

The NRC comments cited in this question reflect no attempt to assess DOE's reasons for using available data as they did. The NRC staff did note that DOE appeared overly optimistic in some of its conclusions in the final Environmental Assessments (EA's). Given the limited data base, any estimates of uncertainty and alternative interpretations are necessarily highly judgmental; hence, differences of technical opinion between technical experts (e.g., DOE and NRC scientists and engineers) such as those documented in the NRC staff's final EA comments can be expected. The important point about the NRC concerns cited in this question is that the test plans in the Site Characterization Plans (SCP's) must recognize uncertainties and a reasonable range of alternative interpretations, in order that data are collected during site characterization to address these uncertainties.

QUESTION 9. In the same response, the NRC has noted concern regarding faults at Yucca Mountain, and that some of the faults have been reactivated by nuclear weapons testing. Would the NRC have any jurisdiction over the location of DOE weapons tests, or over any part of the DOE nuclear weapon testing program, if a repository were to be located at Yucca Mountain?

ANSWER.

The NRC would not have jurisdiction over the location of DOE weapons tests or over any part of the DOE nuclear weapon testing program if a repository were to be located at Yucca Mountain. However, the DOE Siting Guidelines, which specify (10 CFR 960.5-2-4 (d)) that "A site shall be disqualified if atomic energy defense activities in proximity to the site are expected to conflict irreconcilably with repository siting, construction, operation, closure, or decommissioning", preclude selection by the DOE for repository development if weapons testing poses a threat to repository integrity. Furthermore, for DOE to receive a license for the repository at Yucca Mountain, they would have to demonstrate for a conservative range of scenarios that weapons testing would have no impact on the ability of the overall repository system to isolate the waste.

Follow-up Questions to Alvin Weinberg from Senator McClure

April 28 hearing on the Nuclear Waste Program

840

1. Why can't some of the chemically-engineered barriers you have mentioned be adopted for use with relatively young spent fuel (i.e., 30-years of decay rather than the 100 years you mention in your testimony)? As I understand it, the Swedes plan to encapsulate their spent fuel in copper canisters after only 30-40 years of decay.

Chemically-engineered barriers can be used with 30-year decayed fuel. The heat produced at that time is perhaps twice greater than at 100 years decay. This modest reduction in heat probably eases the encapsulation process but is by no means decisive.

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1987 JUL 29 AM 6 08

July 27, 1987

SENATE COMMITTEE ON
ENERGY AND NATURAL RESOURCES
RECEIVED
JUL 29 1987
WASHINGTON, D.C. 20510

The Honorable J. Bennett Johnston, Chairman
Committee on Energy and Natural Resources
United States Senate
Washington, D. C. 20510

Dear Senator Johnston:

I am sorry to be late in responding to your letter concerning information supplemental to my testimony. I have been out of the country for some of this time. Though the responses may be too late for the printed record, I hope that they can address Senator McClure's concerns.

Question 1 - In your testimony, you state that the three site-specific NAS Panels that NAS will establish to oversee DOE's site characterization work will not provide independent verification of the raw data or the overall program adequacy. Why isn't NAS planning to do this? Was this a decision made unilaterally by NAS? by DOE? or jointly? Could NAS provide such independent verification if asked to do so? Why or why not? Wasn't this type of function included in your role with respect to WIPP oversight?

As you know, the members of the National Academy of Sciences-National Research Council's Boards and Panels serve voluntarily. In each of the proposed panels there will be 9 to 11 members. It is not possible for these part-time, unpaid volunteers, who meet for two days three to four times per year, to carry out the amount of detailed analysis required to provide independent verification of the raw data or the adequacy of each item in the program. This type of analysis requires a full-time staff such as that provided by the Nuclear Regulatory Commission and state review organizations. For the reasons cited above, the Boards and Panels could not provide independent verification of the raw data, even if asked to do so.

This is not the role of the National Academy of Sciences-National Research Council. This is also not the role of the WIPP Panel of the NAS Board on Radioactive Waste Management. The Panel has evaluated the overall scientific and technical adequacy of the program and has reviewed in detail selected portions of the program which it considers most crucial and most controversial. During this review, the WIPP Panel has relied heavily on the detailed work done by DOE and its contractors and the State of New Mexico's Environmental Evaluation Group. The Panels to review the scientific and technical adequacy of the characterization of each site would also rely on such evaluations as well as the detailed analysis of the Nuclear Regulatory Commission.

Question 2 - Please distinguish between "independent technical review and evaluation" and "independent verification" in terms of your prospective role in overseeing DOE's site characterization activities.

As stated in the response to Question 1, "independent verification" as defined in Webster's, "to establish the truth, accuracy, or reality of," as compared to "independent technical review and evaluation", "to examine and judge," as defined in Webster's implies determining if each and every number and analysis is properly obtained, whereas review and evaluation means determining if the overall program is adequate and if critical topics are adequately and properly examined.

Question 3 - Have you reviewed the evidence that the states of Nevada, Washington, and Texas have presented what are considered by these states to be "disqualifiers"? What are your reactions to this evidence?

The Board on Radioactive Waste Management has met twice with the States of Nevada, Washington and Texas and the Umatilla, Yakima and Nez Perce Indian tribes and heard their concerns about technical matters, including what they consider to be "disqualifiers." When the Panels are established, I am sure that they will pay particularly close attention to these matters. Without the technical review and evaluation of the states' claims, it is not possible to reach any conclusions.

I was happy to be of service to your committee. If there is anything else I can do, please let me know.

Sincerely yours,

Frank L. Parker, Chairman
Board on Radioactive Waste Disposal
National Academy of Sciences/
National Research Council

FLP:bl

APPENDIX II

Additional Material Submitted for the Record

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

DEC 22 1986

Mr. Stephen H. Kale, Director
Office of Geologic Repositories
U.S. Department of Energy
Washington, DC 20585

Dear Mr. Kale:

The Nuclear Regulatory Commission (NRC) staff has completed its review of the five final Environmental Assessments (EA's) issued by the Department of Energy (DOE) on May 28, 1986 for the first high-level radioactive waste repository. The purpose of this letter is to inform you of the results of our review (Enclosure 1) for consideration by the DOE in the development of the Site Characterization Plans (SCP's).

These NRC staff comments on the final EA's are part of the continuing interface between the staffs of the DOE and NRC which will lead to early identification and resolution of potential licensing issues. In the short term our comments should assist the DOE in preparing high quality SCP's. Therefore, we believe that the opportunity afforded by the final EA's for early interaction between NRC and DOE will be beneficial to the progress of the repository program.

It is apparent that significant efforts were made by DOE to respond to each of the NRC staff major comments on the draft EA's, and in fact, many of these comments have been resolved. However, in each of the final EA's our review identified remaining concerns which are principally related to 1) not identifying the range of uncertainties associated with the existing limited data base, 2) not identifying the range of alternative interpretations and assumptions that can be reasonably supported by existing data, and 3) not incorporating a reasonable range of uncertainties and alternative interpretations into evaluations and conclusions. Based on these concerns we believe that some conclusions in all five final EA's are still overly favorable or optimistic for the areas of comment. At this stage of the site investigation and screening process there is inherent uncertainty in site information that can lead to alternative interpretations of data. Furthermore, resolution of uncertainties -- such as those identified in our comments -- must await detailed site characterization. However, recognition of these uncertainties and alternative interpretations is critical to the development of test plans that will lead to adequate characterization of sites and result in the information needed for licensing. To the extent necessary for demonstrating compliance with 10 CFR Part 60, site characterization testing should lead to narrowing the range of uncertainties, eliminating alternative interpretations and confirming or revising assumptions on the basis of new data and analyses. This narrowing process will not be effective unless test plans recognize the range of uncertainties and alternative interpretations and assumptions that can be reasonably supported by the existing data.

The NRC staff has not attempted, nor do we consider it appropriate to evaluate the ranking of the sites. Accordingly, we have not performed a detailed evaluation of the following two documents: "A Multiattribute Utility Analysis of Sites Nominated for Characterization for the First Radioactive-Waste Repository - A Decision Aiding Methodology (DOE/RW-0074) and "Recommendation by the Secretary of Energy of Candidate Sites for Site Characterization for the First Radioactive-Waste Repository" (DOE/S-0048). The review that was done indicates that conclusions on repository performance in the Methodology Document (DOE/RW-0074) that were derived from evaluations and conclusions in the final EA's, that are considered in our comments to be overly optimistic, are likewise considered optimistic.

Over the past few years we have identified the need for recognizing uncertainties and alternative interpretations in the DOE program as reflected in our comments on the BWIP Site Characterization Report (NUREG-0960), the draft EA's, and the draft Project Decision Schedule. In addition our staffs have met numerous times over the past few years to discuss this subject. While we feel that these interactions have resulted in final EA's which exhibit progress in these areas, we consider that further improvement in recognition of uncertainties and alternative interpretations is still needed. We also recognize the progress that has been made recently by DOE and NRC agreeing on how uncertainties and alternative interpretations will be considered in the SCP's and supporting study plans (NRC/DOE meeting on Level of Detail in the SCP, May 7-8, 1986). However, because of the difficulties encountered in the past in addressing uncertainties and alternative interpretations, we consider it important that our staffs discuss representative comments in these areas as part of our pre-SCP interactions to agree on how they will be considered in the development of test plans. Two representative comments which we consider would serve as timely examples for discussion at technical meetings in the near future are groundwater travel time at the Hanford Site and hydrothermal activity at the Yucca Mountain Site. Mr. Linehan will be contacting your staff to make arrangements for these and other pre-SCP technical meetings.

Sincerely,

R E Browning

Robert E. Browning, Director
Division of Waste Management
Office of Nuclear Material
  Safety and Safeguards

Enclosure:
NRC Staff Comments on the DOE
  Final EA's

NRC STAFF COMMENTS

ON THE

DOE FINAL ENVIRONMENTAL ASSESSMENTS

DECEMBER 22, 1986

DIVISION OF WASTE MANAGEMENT

U.S. NUCLEAR REGULATORY COMMISSION

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INTRODUCTION

Background

The Department of Energy (DOE) issued for public comment nine draft Environmental Assessment (EA's) on December 20, 1984. The Nuclear Regulatory Commission (NRC) reviewed the nine draft EA's and gave DOE comments on March 20, 1985 (SECY-85-114). Subsequent to the public comment period, DOE prepared revisions to the draft EA's in response to comments received from Federal and State agencies, Indian Tribes, various interest groups and members of the public. In accordance with the repository siting guidelines (10 CFR Part 960) the Secretary of Energy on May 28, 1986 issued five final EA's and nominated five sites that he determined suitable for site characterization from the original nine potentially acceptable sites. The five sites nominated are Davis Canyon, Deaf Smith, Hanford, Richton Dome, and Yucca Mountain (the same sites proposed for nomination in the draft EA's). The Secretary of Energy also recommended three of the five sites for site characterization: Deaf Smith, Hanford, and Yucca Mountain (the same sites proposed for recommendation in the draft EA's). The President has approved this recommendation. DOE also issued two other documents titled: "A Multiattribute Utility Analysis of Sites Nominated for Characterization for the First Radioactive-Waste Repository - A Decision-Aiding Methodology" (DOE/RW-0074, referred to below as the Methodology Document) and "Recommendation by the Secretary of Energy of Candidate Sites for Site Characterization for the First Radioactive-Waste Repository" (DOE/S-0048, referred to below as the Recommendation Document). Together with the final EA's these documents provide the support for the DOE nomination and recommendation decisions.

NRC Staff Review

The NRC staff has reviewed and prepared comments on all five final EA's. The staff conducted its review according to the NRC Division of Waste Management's "Standard Review Plan for Final Environmental Assessments" (March 18, 1986), which states that the final EA review is being done 1) to inform the Commission of any major concerns the staff may have with the final EA's and 2) to support NRC's ongoing effort to identify major concerns important to NRC's prelicensing consultation with DOE. The Nuclear Waste Policy Act (NWPA) and NRC regulations governing licensing of the geologic repository provide for consultation between DOE and NRC staffs prior to formal licensing to assure that licensing information needs and requirements are identified at an early time. The final EA's give current information and revised DOE conclusions regarding the sites after considerable evaluation by DOE of numerous comments on the draft EA's. Therefore, they provide current DOE positions and a foundation upon which DOE's project planning (including preparations for the Site Characterization Plans (SCP's) and draft Environmental Impact Statement (EIS)) will be developed for those sites recommended for site characterization.

These NRC staff comments on the final EA's are part of the continuing interface between the staffs of the DOE and NRC which will lead to early identification of potential licensing issues. In the short term our comments should assist the DOE in preparing high quality SCP's. In its concurrence action on the siting guidelines, the Commission found that the guidelines are consistent with the requirements of its own regulations on geologic repositories (10 CFR Part 60). Therefore, while the staff has not identified how its comments relate to the specific requirements of 10 CFR Part 60, the NRC staff considers that they serve to identify open items which are relevant to potential licensing of each site based on information currently available and which will need to be resolved during site characterization. Therefore, we believe that the opportunity afforded by the final EA's for early interaction between NRC and DOE will be beneficial to the progress of the repository program.

The objectives of the NRC staff review are as follows:

1. Identify and document any major concerns with DOE's responses to the NRC major comments on the draft EA's and certain detailed comments (i.e. those referenced by major comments and other detailed comments that now appear to warrant the same attention as the major comments based on the ongoing review of DOE's program). In other words identify residual major concerns not adequately addressed by DOE.

2. Become aware of as well as identify and document any major concerns with new data and information resulting from revisions/additions to the draft EA's by DOE.

3. Identify and document any major concerns with changes to the findings and supporting material in the final EA's.

4. Identify and document major concerns with the technical evaluations in Chapter 7, the Methodology Document, and the Recommendation Document including inconsistencies in use of data, interpretations, etc., between Chapter 7, the Methodology Document, the Recommendation Document and supporting final EA chapters. This does not include a review of the evaluation methodology or the ranking of the sites.

5. Identify and document any inconsistencies between the evaluation methodology in Chapter 7, the Methodology Document, and the Recommendation Document and the siting guidelines as concurred in by the Commission (including whether or not the evaluation methodology is an interpretation of the guidelines).

The final EA review is not a review like that of the draft EA; it is not a comprehensive and detailed review effort to identify every concern and document these concerns as major and detailed comments. The final EA review, as indicated above, focuses only on documenting major concerns in the form of major comments. Detailed comments, which were developed for the draft EA reviews to improve the information provided in the final EA's, were not developed since the EA's are now final. Furthermore, identifying only major concerns sharply focuses on high priority concerns needing attention in the SCP development.

Just as in the draft EA review, the NRC staff has not performed a detailed review with regard to the site characterization plans described in Chapter 4 or the repository descriptions in Chapter 5 of the final EA's. The staff only commented on the plans for characterizing the geohydrological regime beneath Canyonlands, National Park, (close to the Davis Canyon site) because it was a major comment on the draft EA, and because of the potential impact on the park. Site characterization plans and repository descriptions will be reviewed by the NRC staff upon receipt of the SCP's, and comments will be documented in NRC's Site Characterization Analyses.

Because of the limited time available for review relative to the amount of information existing for the five sites, the staff prepared for the final EA reviews long before their receipt. Preparations included 1) reviewing selected new or revised final EA references containing significantly different information, 2) reviewing draft EA comments from States, Indian Tribes, and other Federal agencies, 3) conducting technical meetings with DOE, States and Indian Tribes on selected technical concerns identified in draft EA comments, and 4) conducting selected data reviews and site visits. This early preparation and familiarization with the existing data base has allowed the staff to better determine if the conclusions in the final EA's are consistent with the available data.

Contents

The attached comments describe only major concerns resulting from the review of the final EA's. Therefore, "no comment" merely indicates that no major concerns were identified. Table 1 lists for each final EA the major comments resulting from both the draft and final EA reviews thus indicating in which areas major concerns remain. Major comments are grouped for each of the five final EA's. Within the group of comments for each separate final EA the order is governed by the fact that some comments, which help the reader understand others, come first.

The heading for each comment contains a reference to the appropriate draft EA comment for ease in tracking the staff's concerns back to the original comment. Also identified in the heading for organizational purposes are the relevant guideline conditions. Each comment consists of 1) a statement of the original concern with the draft EA; 2) those portions of the original concern that have been resolved; 3) the remaining major concern(s); 4) the basis for the remaining concern with reference to appropriate sections in the final EA; and 5) the significance of the remaining concern.

Comments that appear nearly identical for the different sites reflect information that was presented in the final EA's that was very similar among sites. Similar comments do, however, take into consideration differences resulting from site-specific information.

CONCLUSIONS AND RECOMMENDATIONS

It is apparent that significant efforts were made by DOE to respond to the NRC staff major comments on the draft EA's, and in fact many of these comments have been resolved. However, for each of the final EA's our review identified remaining concerns many of which are the same type of concerns identified in our review of the draft EA's such as 1) not identifying the range of uncertainties associated with the existing limited data base, 2) not identifying the range of alternative interpretations and assumptions that can be reasonably supported by existing data, and 3) not incorporating a reasonable range of uncertainties and alternative interpretations into evaluations and conclusions. Based on the above we believe that some conclusions in the final EA's are still overly favorable or optimistic for the areas of comment.

In accordance with our review plan, the NRC staff also reviewed aspects of the Methodology Document. As mentioned earlier the NRC staff did not evaluate the ranking of the sites or the ranking methodology itself. Just as was done for the draft EA's, the review focused on the existing data and how that data was used in the evaluations in the final EA's and the Methodology Document. From this review it was clear that evaluations and conclusions regarding site conditions presented in the final EA's were factored into the evaluations of scenarios and their consequences presented in the Methodology Document. Therefore, conclusions on repository performance in the Methodology Document that were derived from evaluations and conclusions in the final EA's, that are considered in our comments to be overly optimistic, are likewise considered to be overly optimistic. Some examples for the Hanford Site are 1) insufficient consideration of flow along large, discrete faults and fracture zones that may exist within dense flow interiors, including consideration of fracture flow as an "unexpected" feature rather than an "expected" one, and 2) inadequate consideration of alternative assumptions regarding pumping for the small-scale exploratory drilling scenario. Some factors which were not given sufficient consideration for the salt sites are 1) effects of host rock mass heterogeneities and 2) shaft and repository sealing concerns related to thermally inducted salt creep and differential uplift. An example from the Yucca Mountain Site is the lack of consideration that hydrothermal activity could be a future source of fluid important to waste package corrosion. For all sites, the effects of alternative corrosion mechanisms were not factored into waste package lifetime analyses. Finally, considering the examples noted above, it is overly optimistic to state on p. 3-41 of the Methodology Document that "When placed on a scale where a zero can be interpreted as performance at the minimum level required by the primary-containment requirements of the EPA standards and 100 is perfection, all of the sites have expected utilities of 99.7 or higher."

The significance of the above concerns is to DOE's ongoing preparation of the SCP's and eventually to site characterization activities, since both the general over optimism as well as the specific concerns could result in inadequate testing programs and inadequate information at the time of licensing. Should the range of uncertainties and alternative interpretations and assumptions that can be reasonably supported by the existing data not be considered in the SCP development, the SCP could be deficient in the identification and description of 1) the site including the range of uncertainties in known site conditions; 2) the issues and information needed to resolve issues; 3) the issue resolution strategies; 4) the performance allocation (i.e. the definition of performance goals and desired, associated confidence levels for various components of the repository system); 5) the investigation and study plans (tests and analyses); and 6) the rationales for investigations and studies with consideration to various sources of uncertainty. To the extent necessary for demonstrating compliance with 10 CFR Part 60, site characterization tests should lead to narrowing the range of uncertainties and eliminating alternative interpretations and confirming or revising assumptions on the basis of new data and analyses. This narrowing process will not be effective unless the test plans recognize the range of uncertainties and alternative interpretations and assumptions that can be reasonably supported by the existing data. It is important to note that because our comments are only related to the material which we reviewed in the final EA, they are not a complete list of our concerns important to the SCP development. We have identified such concerns in our correspondence and technical meeting summaries with DOE.

Over the past few years we have identified the need for recognizing uncertainties and alternative interpretations in the DOE program as reflected in our comments on the BWIP Site Characterization Report (NUREG-0960), the draft EA's, and the draft Project Decision Schedule. In addition, the NRC and DOE staffs have met numerous times over the past few years to discuss this subject. While we feel that these interactions have resulted in final EA's which exhibit some progress in these areas, we consider that further improvement in recognition of uncertainties and alternative interpretations is still needed. In addition, further progress has been made recently by DOE and NRC agreeing on how uncertainties and alternative interpretations will be considered in the SCP's and supporting study plans (NRC/DOE meeting on Level of Detail in the SCP, May 7-8, 1986). For the above reasons we are providing our comments for DOE's consideration. Furthermore, we recommend that because of the difficulties encountered in the past in addressing uncertainties and alternative interpretations we consider it important that the NRC and DOE staffs discuss representative comments in these areas as part of our pre-SCP interactions to agree on how they will be considered in the development of test plans.

TABLE 1 SUMMARY OF CONCERNS WITH THE FINAL EA'S

FINAL EA	DRAFT EA MAJOR COMMENT	CONCERN WITH FINAL EA RESOLUTION*
Hanford	1. Groundwater travel time	Groundwater travel time (5)**
	2. Changes that could affect the geohydrologic regime	No major concern
	3. Geochemical environment	Redox conditions (6)
		Microbial/Organic Complexes and Radionuclide Retardation (new comment based on new information) (7)
	4. Tectonic stability	Potential fault activity (2) Rate and style of deformation (3)
		Seismicity (4)
	5. Natural resources	No major concern
		Potential geothermal resources (new comment based on new information) (1)
	6. Thickness of host rock	No major concern
	7. Shaft construction	No major concern
	8. Waste package lifetime	Waste package lifetime (8)
	9. Surface flooding	No major concerns
	10. Comparative evaluation of sites	No major concerns

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*The concerns found with the final EA resolutions represent a range from essentially no resolution to resolution of all but a few of the original draft EA concerns. It is important to note that even where major concerns remain, some of the original concerns were addressed and in many cases improvements were evident in the final EA's.

**The number in parenthesis is the final EA comment number.

TABLE 1 (CONTINUED) SUMMARY OF CONCERNS WITH THE FINAL EA'S

FINAL EA	DRAFT EA MAJOR COMMENT	CONCERN WITH FINAL EA RESOLUTION
Yucca Mountain	1. Fault activity	Fault activity (1) Northeast trending faults (2) Detachment faulting (3)
	2. Volcanism/hydrothermal activity	Hydrothermal activity (4) Natural resources data relevant to the evaluation (5)
	3. Groundwater travel time calculations	Groundwater travel time (7)
	4. Free drainage of host rock	No major concerns
	5. Groundwater chemistry of the unsaturated zone	No major concerns
	6. Retardation of radionuclides	Retardation of radionuclides (8)
	7. Mineral stability	No major concerns
	8. Radionuclide transport increase due to changes in geohydrologic and climatic conditions	Radionuclide transport increase due to changes in geohydrologic and climatic conditions (6)
	9. Surface flooding	No major concerns
	10. Waste package postclosure performance	Waste package postclosure performance (9)
	11. Comparative evaluation of sites	No major concerns

TABLE 1 (CONTINUED) SUMMARY OF CONCERNS WITH THE FINAL EA'S

FINAL EA	DRAFT EA MAJOR COMMENT	CONCERN WITH FINAL EA RESOLUTION
Davis Canyon	1. Tectonics and structural discontinuities	Structure and tectonics (1)
	2. Dissolution	Dissolution (2)
	3. Groundwater travel time	Groundwater travel time (3)
	4. Hydraulic gradient	No major concern
	5. Host rock carnallite	Decomposition of carnallite (4)
	6. Radionuclide mobility	Redox conditions (5)
	7. Effects of host rock mass heterogeneity	Effects of host rock mass heterogeneity (6)
	8. Retrievability	No major concern
	9. Shaft sealing	Shaft sealing (7)
	10. Waste package performance predictions	Waste package performance prediction (8)
	11. Controlled area	No major concern
	12. Potential field studies in Canyonlands National Park	Potential field studies in Canyonlands National Park (9)
	13. Surface flooding	No major concern
	14. Comparative evaluation of sites	No major concern

TABLE I (CONTINUED) SUMMARY OF CONCERNS WITH THE FINAL EA'S

FINAL EA	DRAFT EA MAJOR COMMENT	CONCERN WITH FINAL EA RESOLUTION
Deaf Smith	1. Structural discontinuities	Dissolution (1)
	2. Dissolution	
	3. Groundwater travel time	Groundwater travel time (2)
	4. Host rock clay content and dehydration	No major concerns
	5. Radionuclide mobility	Redox conditions (3)
	6. Effects of host rock mass heterogeneity	Effects of host rock mass heterogeneity (4)
	7. Retrievability	No major concerns
	8. Shaft sealing	Shaft sealing (5)
	9. Waste package performance predictions	Waste package performance predictions (6)
	10. Controlled area	No major concerns
	11. Surface flooding	No major concerns
	12. Comparative evaluation of sites	No major concerns

TABLE 1 (CONTINUED) SUMMARY OF CONCERNS WITH THE FINAL EA'S

FINAL EA	DRAFT EA MAJOR COMMENT	CONCERN WITH FINAL EA RESOLUTION
Richton Dome	1. Fractures and anomalous zones	No major concerns
	2. Dissolution	No major concerns
	3. Groundwater travel time	No major concerns
	4. Radionuclide mobility	Redox conditions (1)
	5. Effects of host rock mass heterogeneity	Effects of host rock mass heterogeneity (2)
	6. Shaft sealing	Shaft sealing (3)
	7. Retrievability	No major concerns
	8. Waste package performance predictions	Waste package performance predictions (4)
	9. Controlled area	No major concerns
	10. Surface flooding	No major concerns
	11. Comparative evaluation of sites	No major concerns

MAJOR COMMENTS

ON

HANFORD SITE

Comment 1

Potential Geothermal Resources

Guidelines on Natural Resources - 10 CFR 960.4-2-8 (b)(1) and (c)(1)(i)

The analysis presented in the final EA (Section 6.3.1.8,3, page 6-175, last paragraph) on natural resources does not consider new geothermal resource information acquired and evaluated by the Bonneville Power Administration and published in June 1985. This new information considers applications of resources at geothermal temperature gradients equivalent to and less than the Hanford site's gradient of 38°C per kilometer (162°F per mile) (final EA, Section 6.3.1.8.3, page 6-175, last paragraph, and page 6-176, top of page). Available data indicates that the average geothermal gradient at the Hanford site may support low temperature geothermal resource utilization as described in the above-referenced report (BPA, 1985).

The final EA (page 6-175, last paragraph, and page 6-176, top of page) concludes, based on measurements obtained from 15 boreholes drilled in the Pasco Basin, that the geothermal gradient at the Hanford site is approximately 38°C per kilometer (162°F per mile). This is considered insufficient for space heating (final EA, Section 6.3.1.8.3, page 6-176) because space heating requires a geothermal gradient exceeding 45°C per kilometer (182°F per mile). However, the final EA does not consider the potential for the commercial utilization of geothermal resources with temperature gradients lower than those required for space heating. This includes applications for industrial processes, agriculture and aquacultural production (BPA, 1985, Volume 1, page 293, Figure 9-1) which require temperatures ranging from approximately 18°C (65°F) (BPA, 1985, Volume 1, page 293, Figure 9.1) to 44°C (111°F) (BPA, 1985, page 300).

The Bonneville Power Administration, Department of Energy, released the above-referenced report in June 1985, evaluating and ranking the geothermal resource sites in Washington and the three adjacent states of Oregon, Idaho and Montana (BPA, 1985, Executive Summary, page 1, paragraph 1). The report represents a comprehensive, state-of-the-art evaluation of geothermal-economic data (BPA, 1985, Executive Summary, page 1, paragraph 4) and focuses on a broad spectrum of geothermal applications rather than on a single application (space heating) such as was referenced (Stoffel and Korosec, 1984) in the final EA. The report ranked the numerous (1,265) potential sites based upon an estimate of development potential and cost (BPA, 1985, Executive Summary, page 1, paragraph 4). Of the highest ranked direct utilization sites (BPA, 1985, Volume 1, page 315, Table 10.2), many are in proximity (as close as Othello at 25 miles to the northwest, Richland at 27 miles to the southeast, Pasco at 35 miles to the southeast, and Yakima at 45 miles to the west) to the reference repository location (RRL). The report ranked Yakima third in the four state area, Richland eighteenth, Pasco twentieth and Othello fifty-third (BPA, 1985, Volume 1, page 315, Table 10.2). Other highly-ranked sites are located within 45 miles of the RRL.

Comment 2

Potential Fault Activity - (Draft EA Major Comment 4)

Guidelines on Tectonics 10 CFR 960.4-2-7 (a), (b), (c)(2), (c)(6), (d); 960.5-2-11 (a), (b), (d) and Rock Characteristics 960.4-2-3 (a)

In NRC major comment no. 4 on the draft EA for the Hanford site, the concern was raised that existing evidence suggesting recent fault activity at or near the reference repository location (RRL) had not been adequately considered in evaluations related to the tectonic suitability of the site. Specifically, the NRC staff considered that evaluations of existing data indicating the presence of tectonic breccia, geophysical anomalies and microseismic activity in proximity to the RRL should have been incorporated into the draft EA evaluation of tectonic stability. The final EA includes an evaluation of these factors but concludes that the presence of these features does not indicate that potentially adverse structures exist within the RRL. The NRC staff considers that the existing limited data could also support the alternative interpretation that faulting may exist at or near the RRL.

Interpretations presented in the final EA (Section C.5.7, pages C.5-127 to 155) suggest that: (1) tectonic breccias observed in boreholes in the Cold Creek syncline do not indicate the presence of a significant fault zone because they are relatively thin (page C.5-129, 1st paragraph); (2) geophysical anomalies are subtle and cannot be reliably delineated (page C.5-135, 6th paragraph); and (3) extending major structural features into the RRL is conjecture and speculative (page C.5-155, cont. paragraph). The final EA interpretations outlined above are used to support the statement, originally made in the draft EA and repeated in the final EA (final EA, Section 3.2.3.3, page 3-58), that "...the reference repository location appears to be relatively free of potentially adverse structures." The NRC staff, however, remains concerned that the features listed above may indeed indicate the presence of relevant tectonic features within the Cold Creek syncline, and examination of the final EA indicates that this potential has not been factored into evaluations regarding tectonic stability of the RRL. For example, tectonic breccia zones within basalts near Hanford are known to be associated with major geologic structures (final EA, page C.5-127). However, the significance of breccia zones in the Cold Creek syncline is unknown. As stated in the final EA, the breccias suggest that structures of unknown extent, geometry, and dimensions may be present (page C.5-155). Tectonic breccias occur within all deep boreholes and appear to be concentrated in the Grande Ronde and Wanapum basalts possibly suggesting that they may be part of a significant structural feature or features. The fact that breccia zones in the boreholes within the Cold Creek syncline are thinner than they are in anticlines (C.5-129) may not be an indication of the lessening of fault significance away from the anticlines, but rather that the fault is rotating into the plane of bedding and not crossing major bedding surfaces. The characteristics, spatial orientation, and distribution of tectonic breccias are not completely known; thereby increasing the difficulty of assessing the tectonic suitability of the RRL at this time.

The final EA states that active faults do not appear to be present in the reference repository location (final EA, Section 6.3.3.4.1, page 6-248). However, exceptionally great horizontal stresses and related microseismicity (Rockwell, 1985) in the RRL area may indicate that rupture and (or) slip is occurring along either "very small faults or very limited parts of larger faults" (final EA, page C.5-156, paragraph 3). This information indicates that while there may be no surface expression of historical faulting in the Cold Creek syncline, faulting may be occurring in the subsurface. The NRC is concerned that there may be a cause and effect relationship between the tectonic breccias and the microseismicity.

Additional evidence supporting an alternative interpretation that faulting may exist within the RRL are seismic and aeromagnetic surveys that have delineated anomalies within the RRL which have been interpreted as faults (Holmes and Mitchell, 1981). While the nature of these geophysically identified features may not be completely understood, they suggest that structural features (i.e., faults and (or) folds) important to repository design may be present within the RRL.

The NRC staff is also concerned that the final EA has not considered the potential for structures extending to or through the RRL. For example, if extended to the southeast, faults exposed on Umtanum Ridge would pass beneath or through the RRL. The presence of tectonic breccias in drill holes within the RRL and also in association with known faults on Umtanum Ridge provide support to the interpretation that low-angle thrust faults could extend into the RRL (NUREG-0960, page 4-6). The NRC staff considers that combining the evidence for faulting in the Umtanum Ridge and RRL areas is a conservative hypothesis in an area where surface exposures are limited.

Comment 3

Rate and Style of Deformation

Guideline for Tectonics 10 CFR 960.4-2-7 (a)(1), (b)(1), (c)(2), (c)(6), (d)(1) and 960.5-2-11 (a)(1), (b)(1), (d)(1)

The NRC staff review of the draft EA for the Hanford site raised concern that existing geologic information indicates that Quaternary deformation of the Pasco Basin and Columbia Plateau may have occurred at higher rates than was reported in the draft EA. Examination of the final EA indicates that, although the limited existing data base and the need for additional study have been recognized, the final EA has not taken these recognized uncertainties into consideration when evaluating tectonic deformation. The NRC staff considers that the existing limited data could also support an alternative interpretation that deformation has occurred over a much shorter time period and at considerably higher rates than was concluded in the final EA evaluation.

The NRC staff is concerned that the concept of average rate of deformation as used in the final EA may not accurately predict the amount of deformation that has occurred in the Quaternary Period. The final EA indicates that deformation rates for the period 14.5 to 10.5 million years ago (m.y.a.) were between 40 and 80 meters per million years (0.04-0.08 mm/year). These rates of deformation are then projected to the present to give a uniform deformation rate and are used as the primary support for conclusions made in the final EA regarding tectonic suitability of the site. Specific NRC staff concerns related to the use of the average rate of deformation are as follows:

1) The final EA states that deformation in the area of the reference repository location (RRL) has followed an average rate of nearly north-south compression for the past 14 m.y. resulting in east-west trending folds. However, Barresh and others (1983) indicate that while there is evidence of compressive deformation in the Yakima fold subprovince in the period from 16 to 10 m.y.a., compression is believed to have resulted in only mild warping, with most deformation occurring after 10 m.y.a. The mild warping prior to 10 m.y.a. is evidenced by the lack of clear definition of structures on isopach maps of the RRL (LLNL draft letter report dated 9/26/85) which show little evidence of east-west oriented folds until Elephant Mountain member time (approximately 10.5 m.y.a.). Additionally, investigations in the Yakima fold subprovince (Beeson and Moran, 1979; Rockwell, 1979) suggest that northeast and northwest trending structures were formed during this time instead of east-west trending structures now apparent near the RRL. The NRC staff therefore considers that the deformational history observed in the RRL area is more complex than presented in the final EA, and the deformation responsible for structures now present near the RRL may have occurred over a substantially shorter time period (i.e., 10 m.y. to present vs. 14.5 m.y. to present).

2) Deformation rates of 0.1 to 0.14 mm/yr for the period of 10.5 to 4.0 m.y.a. presented by Barresh and others (1983) for the Saddle Mountains are 2.5 to 3.5 times greater than the rate presented in the final EA. Estimates of deformation rates presented by Kienle and others (1978) for the Yakima Ridge give values of 6.5 to 21 times as high as those presented in the final EA for the period between 8 and 4 m.y.a. The NRC staff is therefore concerned that the uniform deformation rate of 0.04 to 0.08 mm/yr. used in the final EA may significantly underestimate the actual deformation rate of the area.

3) The final EA indicates that deformation occurred at a constant rate and orientation over the period of 14.5 m.y. to the present. Although the final EA notes that deformation can be episodic and recognizes that "episodic movements may be significant to repository operations and to waste isolation" (final EA, page C.5-167), conclusions reached about preclosure and postclosure tectonics are based on the concept of uniform deformation over an extended period of time. The NRC staff is concerned that the uniform rate of deformation as used in the final EA does not take

> into consideration that the orientation, style, and intensity of deformation in the Columbia Plateau may have changed significantly in the Late Miocene to Early Pliocene (approximately 5-10 m.y.a.) because of a major clockwise rotation in the regional stress field in the western United States (Eaton, 1984; Zoback and others, 1981). The timing of the stress field rotation roughly coincides with lessening of volcanism following deposition of the Saddle Mountains Basalt (approximately 10-8 m.y.a.) and also with the onset of a major episode of deformation (10-8 m.y.a.) in the Columbia Plateau (Barresh, et al., 1983). The NRC staff is concerned that rather than factoring into the tectonic evaluation the potential for episodic structural events, the final EA assumes that the deformation rate, orientation, and style did not change substantially across a rather dramatic change in the regional stress field. NRC staff considers that without further substantiation, this assumption and the concept of a uniform rate of deformation remain extremely tenuous.

The NRC staff is also concerned that the final EA has not thoroughly considered a substantial body of evidence supporting a "thin-skinned" or regional detachment style of deformation in the area of the RRL. Of particular concern to the NRC staff is the potential for detachment faults or imbricate zones splaying off of detachments (i.e., "thin-skinned" deformation) extending beneath, above, and/or through the repository level.

The final EA states that major faults result from folding and are, therefore, limited to anticlinal features. The final EA further proposed that the mechanism for the development of these folds is the presence of localized detachments beneath anticlines (Price, 1982). This hypothesis is used as the basis for the statement in the final EA that the Cold Creek syncline contains a basically undisturbed sequence of basalt (final EA, page 3-58) because deformation in synclines is not required to accommodate strain. The NRC staff is concerned that sufficient information may not be available to support the localized detachment hypothesis and that other mechanisms of deformation should be considered in a conservative approach to assessing preclosure and postclosure tectonics. Specifically, the NRC staff is concerned (draft EA detailed comment 3-8) about the consequences of "thin-skinned" or regional detachment type (decollement) faulting within the RRL. The NRC staff considers that existing evidence suggests that a regional detachment type fault system may be present at or near the RRL. For example, Laubscher (1981) initially proposed detachment type faulting in this area placing the master detachment near the base of the crust, a second detachment at the base of the basalt column and localized detachments at a depth of 1-3km in the basalt section. The NRC staff has also recognized the possiblity of detachment zones in the vicinity of the RRL. The WNP-2 Safety Evaluation Report states that reverse faults associated with overturned folds on Umtanum Ridge may be part of an imbricate thrust zone partially detached from basement (NRC, 1982). The report further states that the Frenchman Hills and Saddle Mountains are part of this imbricate thrust zone and that at least some of the faults are primary and not related to the effects of folding. In addition, Bentley (1982) indicates that "thin-skinned" tectonics is responsible for overthickening of basalt stratigraphy in deep test wells. He proposes the existence of decollements in sub-basalt and inter-basalt sedimentary layers.

Comment 4

Seismicity of the Reference Repository Location - (Major Comment 4)

Guidelines on Tectonics 10 CFR 960.4-2-7 (b) and (c)(2)

NRC staff comments on the draft EA raised concerns that while microearthquakes were recognized as the primary mode of seismic activity in the region, the potential for such activity to present a near-field seismic hazard was not evaluated. Examination of the final EA (Section C.5.7.3 and Section 6.3.1.7.3) indicates that although the need for additional study has been recognized, the seismic evaluation as presented in the final EA did not take into consideration the potential impact of microearthquake swarms on the tectonic suitability of the reference repository location (RRL). For example, most of the microearthquake swarms reported near the Hanford site have occurred from near surface to 2 kilometers (km) in depth which approximates the depth of the proposed underground facility of the geologic repository. The NRC staff is concerned that the lack of consideration in the final EA for the potential of microearthquake-induced fracturing within the repository horizon may have resulted in overly optimistic conclusions concerning the effects of seismic events on radionuclide release rates.

The final EA concludes that although microearthquakes are expected to occur in the immediate vicinity of the geologic repository during the postclosure period, they are not likely to affect releases of radionuclides to the accessible environment during the first 10,000 years after closure (final EA, Section 6.3.1.7.3). The NRC staff is concerned that, based on available data, many of the hypotheses presented in the final EA to support this conclusion are overly optimistic. For example, the hypothetical model of a microearthquake rupture surface as presented in the final EA (Section 6.3.1.7.3) indicates a relatively shallow dipping single surface involving a rupture of limited extent and a displacement of a few centimeters. A rupture of this type would not increase the permeability of the flow interior to more than the typical Grande Ronde flow top. The NRC staff considers that by using scaling relationships of Brune (1967) and Bonilla et al. (1984), the data could also support a model indicating a typical rupture surface of a microearthquake to be a circular area of approximately 10 to 200 meters radius with an average displacement of approximately ¼ to 11 millimeters for microearthquakes of magnitudes 0 to 3 respectively. Available data indicates that the Cohassett flow ranges in thickness from 73 to 81 meters including a flow top of from 5 to 10 meters in thickness. Assuming the underground facility were situated in the flow interior midway between the Cohassett flow top and the underlying flow top, and assuming a typical microearthquake rupture surface dip of 45 degrees (Malone, et al., 1975), a rupture of approximately 45 meters in length would extend from the underground facility to the flow top. A rupture of at least this length is considered typical for microearthquakes of magnitude 1 or greater. If a microearthquake swarm were to occur in the vicinity of the underground facility, it is possible that several tectonic fractures could be activated since it appears that multiple rupture surfaces have been involved in previous swarms. Thus there is a potential for several paths with permeabilities possibly equivalent to those of flow tops to be opened between the underground facility and the flow tops during a microearthquake swarm.

The occurrence of a microearthquake swarm in the vicinity of the underground facility during preclosure could disrupt operations. If the swarm was in the immediate vicinity of the facility, it could possibly trigger rock bursts, cause damage at sites of high stress, and affect the ground water flow. Microearthquake swarms in the vicinity of the underground facility during postclosure may significantly shorten the travel time for radionuclides to reach the accessible environment by opening paths between the flow interior and the flow tops. Waste canister emplacement space could also be affected by the number and spacing of fractures encountered within the repository. Active tectonic fractures are rarely single fractures but more often are a zone of fractures.

Comment 5

Groundwater Travel Time - (Draft EA Major Comment 1)

Guidelines on Geohydrology 10 CFR 960.4-2-1(b)(1) and 960.4-2-1(d)

The NRC staff's major comment no. 1 on the draft EA for the Hanford site identified five sources of concern regarding the assessment of groundwater travel times: 1) the applicability of previously published travel time estimates; 2) the reliability and representativeness of the data base for transmissivity, hydraulic gradient, and effective thickness; 3) the treatment of these data in deterministic and stochastic models; 4) the treatment of numerical model geometry; and 5) the definition of the orientations and lengths of flow paths (i.e., conceptual groundwater flow models) from the disturbed zone to the accessible environment. Only the first item on this list has been resolved in the final EA by stating that no reliance was placed on the previously published travel time estimates. The NRC staff considers that items numbered 2-5 above remain unresolved.

The NRC staff considers that the hydrogeologic conceptual model of the Hanford site as presented in the final EA is based on a data base that differs little from that used in the draft EA. Application of porous media concepts to describe flow in basalt flow tops and interiors continues to be an inadequately supported assumption in the final EA. The characteristics of hydrogeologic boundaries as well as the directions and magnitudes of both horizontal and vertical groundwater flow in the basalt aquifer system are still not well understood. The final EA did not consider hydraulic responses caused by construction of borehole DC-23. These responses suggest that large scale heterogeneities involving varying degrees of aquifer interconnection may be present in the vicinity of the RRL. There are also concerns about the limited extent to which existing hydrochemical data at Hanford (in particular, long-lived radionuclide data) have been used to assess and corroborate conceptual models of groundwater flow. For example, current conceptual models of groundwater flow in confined aquifers at Hanford are not fully consistent with available hydrochemical data, which can be interpreted to show varying degrees of aquifer interconnection. Of particular importance in such evaluations of conceptual models is the occurrence and distribution of long-lived radionuclides such as I-129, Cl-36, and Tc-99. These radionuclides can also be useful in evaluating groundwater recharge and discharge and migration paths of future and existing contaminants at the Hanford site.

In addition, new information presented in the final EA raises additional concerns about the overall groundwater travel time methodology. The staff considers that neither the final EA nor its supporting document (Clifton, 1986) provide sufficient supporting information with respect to the formulation of the five basic models used to predict groundwater travel times, thereby reducing the level of confidence placed on the travel times presented in the final EA. From the information provided, it can only be assumed that the methodologies used to calculate groundwater travel time in the draft and final EA's are similar (Clifton, 1984; Clifton et al., 1984). Specifically, information has not been provided with respect to boundary conditions, the number and size of model elements, number of calculated realizations, and modeling procedures and logic. Additionally, there is no indication that the model results were checked for sensitivity to the number of realizations. The absence of this supporting information raises questions with respect to utilization of model output distributions of groundwater travel time. By comparison, significantly more information on computational procedures was presented in the draft EA and its supporting documents (Clifton et al., 1984).

The NRC staff review of the draft EA raised concerns regarding the reliability of the preliminary geohydrologic data base. On page C.5-60 of the final EA it is stated that "... the available hydrologic data base is good." On page C.5-180, under discussion of the transmissivity data base, it is stated that the ensemble of Grande Ronde flow-top transmissivities is used (in the absence of specific data) to generate a representation of the flow top overlying the repository, and that "[T]he practice of using surrogate data sets to make initial predictions of performance for design purposes is common in the disciplines of engineering and hydrology." Although this situation is unavoidable at this early stage of site investigations, it is premature to refer to the overall data base as being "good" with respect to calculating groundwater travel times.

The NRC staff has previously questioned the adequacy and reliability of all of the data sets (transmissivity, hydraulic gradient, and effective thickness) on which the simulated travel times are based. In particular, the staff has questioned, based on existing data, the parameter ranges selected for use in the simulation calculations. For example, the final EA utilized a uniform distribution for effective porosity (derived from effective thickness) that is biased toward high values. The NRC staff considers the use of a log-uniform distribution with a median value centered about a value of effective porosity derived from the field test of effective thickness to be a more realistic and conservative approach. Similarly, problems exist with the selection of parameter ranges for transmissivity, vertical hydraulic conductivity, and hydraulic gradient.

In addition, it is noted that conclusions presented in the final EA based on the groundwater travel time analyses are primarily discussed in terms of the "median" travel times. The NRC staff considers this approach to be nonconservative because the median provides no information regarding uncertainties associated with estimates of groundwater travel times, and does not adequately address scenarios involving faster paths of likely radionuclide travel. In addition, the median travel time percentile is less sensitive to the variance of the travel time distribution than are lower or higher cumulative percentiles in the "tails" of the groundwater travel time distribution. Conclusions based on median values are less sensitive to the uncertainty implicit in hypotheses of groundwater flow system behavior. Use of a percentile smaller than the median would be more appropriate, because corresponding travel times are more sensitive to the spatial variability of field parameters, reliability of conceptual models, adequacy of hydrologic field testing, and measurement error.

The final EA concludes that groundwater travel time at the Hanford site "... has a high likelihood of exceeding 1000 years" (Volume 2, page 6-100). As discussed above, the NRC staff considers that such high levels of confidence cannot be assigned to any estimates of groundwater travel time at Hanford because of the limited hydrogeologic data base and of concerns regarding analyses and interpretations presented in the final EA. In addition, the staff considers that NRC's major comment no. 1 on the draft Hanford EA remains applicable to the groundwater travel time analyses in the final EA, with the exception of the concern about the reliability of previous groundwater models. Therefore, based on the existing limited data base and concerns expressed above, the staff considers that groundwater travel time estimates presented in the Hanford EA are overly optimistic and that travel times based on available data may be significantly closer to 1000 years than stated in the final EA.

Comment 6

Redox Conditions (Draft EA Major Comment 3)

General Geochemical Guideline 10 CFR 960.4-2-2

In NRC staff major comment no. 3 on the draft EA for the Hanford site, the concern was raised that the conclusions that site redox conditions are not "... chemically oxidizing" and that the reference repository has chemically reducing conditions that will maintain radionuclides in their least mobile state are based on insufficient data. Examination of the final EA (Volume 2, Section 6.3.1.2.2, page 6-109; Volume 2, Section 6.3.1.2.10, pages 6-123 and 6-124; Volume 3, Section C.5.2.1, pages C.5-81 through C.5-88; among others) indicates that although the draft EA concerns have been acknowledged, the evaluation in the final EA of pre- and post-waste emplacement geochemical characteristics of the Hanford site and the significance of these characteristics on radionuclide retardation is still optimistic. Therefore, the NRC staff considers that draft EA major comment no. 3 remains appropriate for the final EA. Draft EA comment no. 3 expressed the NRC staff concern that the effects of reaction kinetics may prevent the establishment of redox equilibria, and may inhibit either the transformation or the maintenance of radionuclides as reduced species. This concern is supported by Lindberg and Runnells (1984) who state (1) "... that equilibrium modeling of the redox chemistry of natural aqueous systems is not realistic as computed from Eh or pE as a 'master' redox variable," (2) "Equilibrium modeling should therefore be restricted to non-redox systems," and (3) "If redox chemistry is to be considered, investigations must analyze the waters for the specific valence states of the elements of interest...." Further, according to Hostettler (1984), predicting the valence states of multivalent radionuclides (and thus the mobility of radionuclides) requires analysis and knowledge of the kinetics of all relevant reactions. The NRC staff therefore considers that prediction of the valence states of radionuclide species should be made only to the extent that the behavior of the constituents can be shown to mimic the behavior of the couples measured. Accordingly, a realistic but conservative alternative assumption for those radionuclides for which this information has not been collected, or where the information is ambiguous, is that they will be released and move through the system as oxidized species.

In addition to the draft EA concerns being appropriate to the final EA, the NRC staff is also concerned with the final EA statement that there are "... strong indications that the reference repository location has chemically reducing conditions that will promote precipitation and will maintain radionuclides in their least mobile state ..." (See final EA, Volume 1, Section 6.2, page 16). Although the NRC agrees that available information indicates that ambient redox conditions are likely to be reducing (i.e., Eh less than 0.0 volts) in deep basalt groundwater systems, evidence presented in the final EA, such as equilibrium calculations of non-equilibrium redox couples involving either sulfate or methane (see final EA Comment 7), does not necessarily indicate that the Eh will either be reducing or as low as -0.4 volts as is suggested in the final EA (Baas-Becking et al., 1960; Thorstenson, 1970; Berner, 1971; Langmuir, 1971). Also, as previously stated, the likelihood that reducing conditions are present does not support equilibrium modeling of redox sensitive radionuclides as reduced species because what may be reducing for one redox couple could be oxidizing for another. Also, an additional source of concern is the incomplete discussion in the final EA of the impact of atmospheric oxygen introduced into the repository during construction and waste emplacement. For example, laboratory tests conducted by Apted and Myers (1982); Lane et al. (1983a and 1983b); Jantzen (1983); Grandstaff et al. (1984) and Moore et al. (1985) using crushed rock, and in some cases distilled water, are cited as support for the conclusion in the final EA that basalt can rapidly re-establish reducing conditions in the repository subsequent to closure. However, these references also support an alternative and more conservative conclusion that the re-establishment of ambient reducing conditions may be slow since the massive basalt host rock will not react as fast upon contact with the groundwater as does crushed rock. While it is acknowledged in the final EA that the experimental work cited had been completed with crushed basalt, the alternative interpretation of the experimental data was not identified in the final EA. Based on the above discussion, it is not clear that a conservative approach was taken as stated in the final EA (Volume 3, Section C.2.7.4, page C-2-78; and Volume 2, Section 6.1.2, page 6-4) in evaluating site redox conditions and their effect on the performance of the repository.

Comment 7

Microbial/Organic Complexes and Radionuclide Retardation (Draft EA Major Comment 3)

General Geochemical Guideline 10 CFR 960.4-2-2

In NRC staff major comment no. 3 on the draft EA for the Hanford site, reference was made to detailed comment 6-33 where the concern was raised that equilibrium between the redox couples sulfate/sulfide and methane/carbon dioxide, used to suggest non-oxidizing conditions, is unusual because such reactions require biological mediation and are not generally found to be electrochemically active. The final EA suggests that "(t)he presence of...certain bacteria..." in the Hanford site basalt environment may, in fact, help catalyze these redox couples (Volume 3, Section C.5.2.1, page C.5-82). However, the NRC staff considers that while the presence of bacteria in the geochemical system at Hanford may help resolve the redox concern, they could also result in a significant new concern by increasing the mobility of some radionuclide species. This possibility has not been recognized or factored into evaluations of radionuclide mobility in the final EA.

According to West et al. (1984), radionuclide microbial/organic complexes have different migration characteristics than inorganic complexes. For example, such material may form complexes with radionuclides, resulting in higher apparent solubilities, lower effective sorption and hence, higher release rates. The ultimate effect of microbes/bacteria/organics could therefore be an enhancement of radionuclide mobility thereby impacting the anticipated performance of the site (NRC, 1984).

Comment 8

Waste Package Lifetime - (Draft EA Major Comment 8)

In the NRC staff's major comment no. 8 on the draft EA for the Hanford site, concerns were raised on the draft EA's estimation of a 6,000 year waste package lifetime. Specifically, four areas of concern regarding the estimate of container lifetime were identified: 1) the oxidizing environment during repository operation and after closure; 2) localized corrosion as a waste package failure mode; 3) the effect of packing on corrosion of the overpack material; and 4) the effect which instability of packing may have on ingress of water as well as on the migration of radionuclides through the packing material. Examination of the final EA (Sections 6.4.2.1, 6.4.2.3, and 6.4.2.4) indicates that items 1 and 3 above have not been addressed, while items 2 and 4 have only been partially addressed. The NRC staff therefore considers that draft EA comment no. 8 applies equally well to the final EA. For example, while the final EA states that localized corrosion failure modes such as stress corrosion cracking (SCC) and pitting will be incorporated into future corrosion models (page 6-283), the document concludes on page 6-121 that "pitting and stress corrosion cracking will not be active corrosion modes." The NRC staff has identified major sources of uncertainty not recognized in the three references provided in the final EA as support for this statement (Lumsden, 1985; Pitman, 1985; and James, 1985). Major concerns identified in Lumsden, 1985 by the NRC staff include: (1) Lumsden's data was not measured in the presence of a radiation field which will be present in a repository environment; (2) the pitting potentials given in the paper may be uncertain*; (3) additional measurements (e.g. cyclic polarization) are needed to better determine pitting potentials and pit incubation times; and (4) alternate wetting and drying data at increased temperatures and times are also needed for projecting corrosion rates. In contradiction to the conclusion drawn in the final EA, one of the conclusions of the James paper referenced above states, "the tentative conclusion is that limited crack extension may have occurred." In other words, stress corrosion cracking (SCC) may have occurred for the A387-9 steel at 250°C after 2000 hours. Additionally, the Pitman paper stated,

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*The pitting potentials given were determined only from the breakdown potentials of anodic polarization curves. Cyclic polarization data are needed in order to determine whether hysteresis is present. If hysteresis is present there will exist a protection potential which is different from Lumsden's pitting potential. In order for pitting not to occur under repository conditions, the potential must be less than the protection potential. Since the cyclic polarization data was not measured by Lumsden, it is not obvious what the protection potential is for these materials. Consequently, in this case it cannot be stated that pitting will not occur under repository conditions. It should also be noted that if pitting does occur, both the protection potential and the pitting potential (as measured by Lumsden) for the material would shift toward the corrosion potential.

"In summary, both 9% Cr, 1% Mo steel and A27 steel were found to be susceptable to decreasing ductility in 150°C basalt groundwater at low strain rates." Pitman further concludes that SCC exists in the low alloy A387 steel. For the A27 steel, even though Pitman concludes that there was no SCC observed, the reduced ductility implies a high probability that SCC may occur over a longer time period.

With reference to the NRC staff's draft EA concern related to packing instability (item 4 above), page 6-120 of the final EA comments on the bentonite instability results of Haire and Beall (1979), the NRC staff notes that a change in crystal structure of the bentonite is not necessarily a function of only the radiation dose rate, but also of the total dosage. The final EA states that the dose rate (3×10^9 rad/hr.) for the Haire and Beall (1979) work was 10^5 times what is expected in the repository. Therefore, using a dose rate of 3×10^4 rad/hr., the total dosage expected in one year is 3×10^9 rads. After only 1000 years, the total dosage would be 3×10^{11} rads which is about what Haire et al. used. Therefore, the statement in the final EA that the negative results of this study are "not considered applicable" due to the high dose rate is considered inappropriate by the NRC staff.

In addition to the above, the final EA also presented a revised waste package conceptual design which incorporates an outer carbon steel shell surrounding the overpack and preformed annular sections of packing material (see Figures 5-7, page 5-36; and 5-9, page 5-38). As discussed in §5.1.5.3 of the final EA, "The function of the shell is to facilitate handling and emplacement of the waste package components. The shell also has the potential to facilitate retrieval of the waste container by preserving the packaging in a dry state and by providing additional structural strength."

It is the NRC staff's opinion that this design change may improve the performance of the waste package in terms of waste package lifetime and controlled radionuclide release should the waste packages fail. However, the waste package performance analysis does not reflect this design change. Additionally, new potential failure modes for this design were not addressed in the final EA. For example, the temperature of the waste container is estimated to have a maximum value of 300°C, but more likely about 220°C (NUREG/CR-2482). If the waste package is a sealed system, water present in the packing will change to steam, increasing the pressure in the new outer metal shell. This could result in distortion of the shell making retrieval more difficult. Alternatively, in an unsealed waste package system, contact of the packing with groundwater may cause significant swelling presenting retrieval problems as well as potential vessel rupturing.

REFERENCES

Apted, M.J., and J. Myers, 1982. Comparison of the Hydrothermal Stability of Simulated Spent Fuel and Borosilicate Glass in a Basaltic Environment, RHO-BW-ST-38P, Rockwell Hanford Operations, Richland, Washington.

Baas - Becking, L.G.M., I.R. Kaplan, and D. Moore, "Limits of the Natural Environment in Terms of pH and Oxidation Reduction Potentials," Journal of Geology, Vol. 68, pp. 243-284, 1960.

Barresh, W., Bond, J., and Venkatakrishnan, R., 1983, Structural evolution of the Columbia Plateau in Washington and Oregon: American Journal of Science, v. 283, p. 897-935.

Beeson, M.H., and Moran, M.R., 1979, Columbia River Basalt Group stratigraphy in western Oregon: Oregon Department of Geology and Mineral Industries: Oregon Geology, v. 41, no. 1, p. 11-14.

Bentley, R.D., 1982, Late Tertiary thin skin deformation of the Columbia River Basalt in the Western Columbia Plateau, Washington-Oregon: EOS, v. 63, no. 8, p. 173.

Berner, R.A., Principles of Chemical Sedimentology: New York, McGraw-Hill, 240 p., 1971.

Bonilla, M.G., R.K. Mark, and J.J. Lienkaemper, 1984, "Statistical Relations among Earthquake Magnitude, Surface Rupture Length, and Surface Fault Displacement," Bulletin of the Seismological Society of America, vol. 74, pp. 2379-2411.

BPA (Bonneville Power Administration, U.S. Department of Energy), "Evaluation and Ranking of Geothermal Resources for Electrical Generation or Electrical Offset in Idaho, Montana, Oregon and Washington," WAOENG-85-02c, DOE/BP-13609-3, 3 Vols., Portland, Oregon, June, 1985.

Brune, J.N., 1967, "A Low Stress-Drop, Low-Magnitude Earthquake with Surface Faulting: The Imperial, California, Earthquake of March 4, 1966," Bulletin of the Seismological Society of America, vol. 57, pp. 501-542.

Clifton, P.M., 1984. Groundwater Travel Time Uncertainty Analysis - Sensitivity of Results to Model Geometry, and Correlations and Cross Correlations Among Input Parameters: Rockwell Hanford Operations, SD-BW-TI-256.

Clifton, P.M., 1986. Groundwater Travel Time Analysis for the Reference Repository Location at the Hanford Site: Rockwell Hanford Operations, SD-BWI-TI-303.

Clifton, P.M., R.C. Arnett, and N.W. Kline, 1984. Preliminary Uncertainty Analysis of Pre-Waste-Emplacement Groundwater Travel Times for a Proposed Repository in Basalt: Rockwell Hanford Operations, SD-BWI-TA-013.

Eaton, G.P., 1984, The Miocene Great Basin of Western North America as an extending back-arc region: Tectonophysics, v. 102, p. 275-295.

Grandstaff, D.E., G.L. McKeon, E.L. Moore, and G.C. Ulmer, 1984. "Reactions in the System Basalt/Simulated Spent Fuel/Water," Scientific Basis for Nuclear Waste Management VII, G.L. McVay (ed.), Proceedings of the Material Research Society Symposium, Vol. 26.

Holmes, G.E., and Mitchell, T.H., 1981, Seismic reflection and multilevel aeromagnetic surveys in the Cold Creek syncline area; Appendix B, in Subsurface geology of the Cold Creek syncline: RHO-BWI-ST-14, p. B-1 to B-56.

Hostettler, J.D., "Electrode Electrons, Aqueous Electrons, and Redox Potentials in Natural Waters," American Journal of Science, Vol. 284, pp. 734-759, June, 1984.

James, L.A., 1985. Short-Term Stress Corrosion Cracking Tests for A36 and A387-9 Steels in Simulated Hanford Groundwater, SD-BWI-TS-012, Richland, Washington.

Jantzen, C.M., 1983. Methods of Simulating Low-Redox Potential (Eh) for a Basalt Repository, DP-MS-83-59X, E. I. DuPont de Nemours & Co., Savannah River Laboratory, Aiken, South Carolina.

Kienle, C.F., Jr., Bentley, R.D., Farooqui, S.M., Anderson, J.L., Thoms, R.E., and Couch, R.C., 1978, The Yakima Ridges--An indication of anomalous Plio-Pleistocene stress field, Geological Society of America Abstracts with Programs, v. 10, no. 3, p. 111.

Lane, D.L., M.J. Apted, C.C. Allen, and J. Myers, 1983a. The Basalt/Water System: Considerations for a Nuclear Waste Repository, RHO-BW-SA-320, Rockwell Hanford Operations, Richland, Washington.

Lane, D.L., T.E. Jones, and M.H. West, 1983b. "Preliminary Assessment of Oxygen Consumption and Redox Conditions in a Nuclear Waste Repository in Basalt," Geochemical Behavior of Disposed Radioactive Waste, G.S. Barney, J.D. Navratil, and W.W. Schulz (eds.), ACS Symposium Series 246, 1984, American Chemical Society, Washington, D.C.; also RHO-BW-SA-283 P, Rockwell Hanford Operations, Richland, Washington.

Langmuir,-D., "Eh-pH Determinations," in Procedures in Sedimentary Petrology (Carver Edition), pp. 597-635, 1971.

Laubscher, H.P., 1981, Models of the development of Yakima deformation, in Final Safety Analysis Report WNP-2, Amendment no. 18, Appendix 2.5-O, Washington Public Power Supply System, Richland, Washington.

Lindberg, R.D., and D.D. Runnells, 1984, "Ground Water Reactions: An Analysis of Equilibrium State Applied to Eh Measurements and Geochemical Modeling," Science, Vol. 225, pp. 925-927.

LLNL, 1985, Transmittal of report entitled "Preliminary data and report on the timing and style of deformation since the Miocene Epoch in the Yakima fold belt": Lawrence Livermore National Laboratory letter dated September 26, 1985.

Lumsden, J.B., 1985. Pitting Behavior of Low-Carbon Steel, SD-BWI-TS-014, Rockwell Hanford Operations, Richland, Washington.

Malone, S.D., G.H. Rothe, and S.W. Smith, 1975, "Details of Microearthquake Swarms in the Columbia Basin, Washington," Bulletin of the Seismological Society of America, vol. 65, pp. 855-864.

Moore, E.I., G.C. Ulmer, and D.E. Grandstaff, 1985, "Hydrothermal Interaction of Columbia Plateau Basalt from the Umtanum Flow (Washington, U.S.A.) with Its Coexisting Groundwater," Chemical Geology, Vol. 49, pp. 53-71 (Also RHO-SD-BWI-TI-228).

NRC (U.S. Nuclear Regulatory Commission) 1982, Safety Evaluation Report (related to construction of Skagit/Hanford Nuclear Project, Units 1 and 2): NUREG-0309, Supplement No. 3.

NRC, 1983, Draft site characterization analysis of the site characterization report for the Basalt Waste Isolation Project: NUREG-0960.

NRC, 1984, "Draft Issue-Oriented Site Technical Position (ISTP) For Basalt Waste Isolation Project (BWIP)."

NUREG/CR-2482 Vol. 3. Review of DOE Waste Package Program, Brookhaven National Laboratory, March 1983 p. 14.

Pitman, S.G., 1985. Slow-Strain-Rate Testing of 9%Cr - 1%Mo Wrought Steel and ASTM A27 Cast Steel in Hanford Grande Ronde Groundwater, SD-BWI-TS-008, Rockwell Hanford Operations, Richland, Washington.

Price, E.H., 1982, Structural geometry, strain distribution, and tectonic evolution of Umtanum Ridge at Priest Rapids, and a comparison with other selected localities within Yakima fold structures, south-central Washington, RHO-BWI-SA-138, Rockwell Hanford Operations, Richland, Washington.

Rockwell, 1979, Geologic studies of the Columbia Plateau, a status report: Rockwell Hanford Operations, Richland, Washington, Report RHO-BWI-ST-4.

Rockwell, 1985, Geoengineering design parameters workshop: Proceedings of a workshop held in Rapid City, South Dakota: BWI-TI-299, Rockwell Hanford Operations, Richland, Washington.

Stoffel, K.L., and M.A. Korosec, "Low Temperature Geothermal Resources of the Columbia Basin, Eastern Washington," Washington Geologic Newsletter, Vol. 12, No. 4, pp. 5-11, October, 1984.

Thorstenson, D.C., Equilibrium Distribution of Small Organic Molecules In Natural Waters," Geochem. et Cosmochim. Acta, Vol. 34, pp. 745-770, 1970.

West, J.M., P.J. Hooker and I.G. McKinley, "Geochemical Constrants On the Microbial Contamination of A Hypothetical UK Deep Geological Repository," Fluid Processes Research Group (FLPU), FLPU 84-8, British Geological Surrey - Natural Environment Research Council, 1984.

Zoback, M.L., Anderson, R.E., and Thompson, G.A., 1981, Cainozoic evolution of the state of stress and style of tectonism of the Basin and Range Province of the Western United States: Philosopical Transaction of the Royal Society of London, v. 300, p. 407-434.

MAJOR COMMENTS

ON

YUCCA MOUNTAIN SITE

Comment 1

Fault Activity (Draft EA Major Comment 1)

Guidelines on Tectonics 10 CFR 960.4-2-7 (d); and 960.5-2-11 (a),(c)(3)

In NRC staff major comment 1 on the draft EA for Yucca Mountain the concern was raised that despite indications elsewhere in the draft EA that the faults in the vicinity of Yucca Mountain are considered as potentially active, they are considered to be not active in the assessment of the expected nature and rates of fault movement at the Yucca Mountain site. Preliminary seismic assessments in the final EA are still based on the assumption--supported by some justification (final EA, Section C.4.1.1, page C.4-5)--that the faults at Yucca Mountain are not active (final EA, Section 6.3.1.7.5, page 6-275, last paragraph). However, elsewhere in the final EA (Section 6.3.1.7.4, pages 6-267 and 6-268) the faults are considered as potentially active; in light of the evidence supporting that position--in the final EA and in this comment--the NRC considers that the concerns expressed in the original comment remain relevant to the discussions in the final EA.

Justification for the assumption in the final EA that the faults at Yucca Mountain are not active is identified as being obtained from U.S.G.S. Open File Report 84-792 (final EA, page C.4-5, last paragraph). However, the interpretation presented in U.S.G.S. (1984) is at least in part based on the assumption that maximum and intermediate principal stresses are essentially equal (U.S.G.S., 1984, page 76), an interpretation that has recently been disputed (Healy and others, 1984; Stock and others, 1985). In addition, there is a growing body of evidence that supports an interpretation that at least some of the north-trending normal faults in the vicinity of Yucca Mountain have had movement in the last 40,000 years. The primary evidence for Holocene faulting at Yucca Mountain is a thermoluminescence age of approximately 6000 years for latest movement on a fault in the eastern part of Crater Flat (final EA, page 3-20, 1st paragraph). Isotopic evidence from other parts of the NTS supports ages of less than 40,000 years for latest movement along favorably oriented faults. This evidence includes ages of approximately 35,000 years and 37-97,000 years for the last natural movement on the Yucca and Carpetbag faults respectively (Knauss, 1981). At least portions of the Yucca fault may have had natural movement as recent as 1000 years ago (Knauss, 1981).

Both the Carpetbag and Yucca faults and similarly oriented faults in Pahute Mesa have been reactivated by nuclear weapons tests suggesting that stress magnitudes in the vicinity of the faults are at or close to values at which failure would occur along favorably oriented structures (final EA, page 6-268). At Yucca Mountain, hydrofrac tests in holes USW G-1 and G-2 by Stock and others (1985, page 8705) indicate that stress magnitudes at Yucca Mountain have measured values "close to values at which slip would occur on favorably oriented faults" (also see Healy and others, 1984). The fact that slip is occurring along favorably oriented structures is supported by seismic evidence that indicates that north trending faults are active on the NTS. For example, earthquakes associated with northeast-trending faults are believed to be associated with "shorter intervening fault segments with a north strike" (final EA, page 3-20, 3rd paragraph).

Comment 2

Northeast-Trending Faults-(Draft EA Detailed Comments 3-2, 3-3, 3-4, 3-5, 3-8)

Guidelines on Tectonics 10 CFR 960.4-2-7 (c)(5), (c)(6), (d) and 960.5-2-11 (c)(3), (d)

In several comments on the draft EA (detailed comments 3-2, 3-3, 3-4, 3-5, 3-8) the NRC staff indicated that the limited recognition and discussion of northeast-trending strike-slip faults near Yucca Mountain contributed to an inadequate assessment of the nature and rate of fault movement at the Yucca Mountain site. Examination of the final EA shows that consideration of those faults is still limited. In fact, the importance of the northeast-trending structures was de-emphasized by the omission of the northeast-trending Mine Mountain fault from figure 3-4 (final EA, page 3-14, map portraying major Basin-Range faults) and by the lack of discussion of Maldonado's (1985) map of the Jackass Flats area on which he extends the Mine Mountain fault zone across Jackass Flats east of Yucca Mountain. The NRC staff considers that the original comments remain relevant to the final EA and that the omission of the northeast-trending strike-slip faults reflects inadequate recognition of current uncertainties regarding the nature and rates of fault movement.

The bases for the concerns raised by the NRC staff relate to the aforementioned Mine Mountain fault in particular and to five features of northeast-trending faults in the Yucca Mountain area in general (detailed below). These six factors strongly suggest that northeast-trending faults are an important tectonic element in the seismotectonic evaluation of the Yucca Mountain site.

1) Historical seismicity is associated with the northeast-trending Mine Mountain, Rock Valley, and Cane Spring strike-slip faults (20, 26, and 28 kilometers from the site respectively) (U.S.G.S., 1984). Northeast-trending strike-slip faults are considered to be the most seismically active faults on the NTS (McKague and Orkild, 1984; U.S.G.S., 1984).

2) The southeastern corner of Yucca Mountain lies along the western margin of the Spotted Range-Mine Mountain structural zone, a major northeast-trending structural belt (Carr, 1984). The Mine Mountain fault, a major northeast-trending seismically active fault within the Spotted Range-Mine Mountain structural zone, trends southwestward into Jackass Flats (U.S.G.S., 1984, Figure 3) and may extend across Jackass Flats (Maldonado, 1985). Extension of the Mine Mountain fault southward through Jackass Flats brings the fault closer to Yucca Mountain than the 14 km which separates the Bare Mountain fault from the repository site. The Bare Mountain fault is used as the baseline for seismic risk (final EA, Section 6.3.1.7.5, page 6-276).

3) Scott and Bonk (1984) mapped an area of very closely spaced, northeast-trending faults in the southern part of the site (final EA, page 3-15, first paragraph). The significance of these northeast-trending faults at Yucca Mountain and their potential for movement in the present stress field is unknown.

4) A northeast-trending aeromagnetic lineament that passes through the center of Lathrop Wells basalt center is located just to the south of the site and east of Busted Butte (Carr, 1984, Figure 28). Maldonado (1985) places a northeast-trending fault along the trend of this aeromagnetic lineament (approximately 8 km from the repository site) extending the fault northeastward into the Shoshone Mountain area. Northeast-trending faults are known to be present on Yucca Mountain and Busted Butte; the relation of these faults to the aeromagnetic lineament (fault?) and to seismicity in the Spotted Range-Mine Mountain structural zone is unknown.

5) Volcanism, particularly younger basaltic activity, is oriented along a fairly consistent northeast trend (Carr, 1984). This northeast-trending belt of basaltic volcanism near Yucca Mountain is termed the Death Valley-Pancake Range belt by Carr (1984) and is known for its relative youthfulness and association with a higher than regional tectonic flux. Of concern to the NRC staff is the relationship of volcanism to the northeast-trending faults near Yucca Mountain as possibly demonstrated by the association of Lathrop Wells basalt center to the northeast-trending aeromagnetic lineament passing just to the east of Busted Butte (Carr, 1984).

The NRC staff considers that the lack of a comprehensive evaluation of northeast-trending structural features could result in underestimated values for magnitudes of vibratory ground motion and the potential for volcanism at the repository. In the final EA, the Bare Mountain fault is used for the determination of seismic risk. The U.S.G.S. (1984) states that if faults nearer to Yucca Mountain than the Bare Mountain fault are found to be active, then acceleration estimates determined for Yucca Mountain could be much higher. The Mine Mountain fault and its possible extension through Jackass Flats, the closely spaced faults of Scott and Bonk (1984), and the northeast-trending aeromagnetic lineament (Carr, 1984) are all important tectonic elements in the determination of seismic risk at Yucca Mountain.

Comment 3

Detachment Faulting

Guidelines on Tectonics 10 CFR 960.4-2-7 (c)(5), (c)(6), (d); and 960.5-2-11 (c)(3), (d)

The final EA states that low-angle detachment faults may be present below Yucca Mountain and that the possibility that they do exist will be explored during site characterization (final EA, Section C.4.1.1, page C.4-4, 4th paragraph). Based on documented evidence of the development of detachments in the Basin and Range Province during the mid-Miocene, it is reasonable to suggest the possible presence of detachments beneath Yucca Mountain. The NRC staff is concerned because recent publications (Scott, 1986; Scott and Rosenbaum, 1986) have suggested that detachment faulting may be a much more important element in the tectonic setting of Yucca Mountain than previously believed and because the implications of these features with respect to associated normal faults which intersect and bound the repository site have not been adequately addressed in the final EA. The NRC staff considers that omission from the final EA of the possible implications of detachment faulting and related listric normal faulting at Yucca Mountain reflects inadequate recognition of current uncertainties regarding the nature and rates of faulting during the Quaternary.

Scott (1986) implies that normal faults present at Yucca Mountain are connected to and are imbricates from a detachment surface at the Tertiary-Paleozoic boundary (depth of approximately 2 km). Moreover, to the northwest of Yucca Mountain, Hardyman (1984) has observed detachment surfaces at the Tertiary-pre-Tertiary contact and at most contacts throughout the Tertiary section. He also notes that high-angle shear planes can become quite common (several per meter) above detachment surfaces (Hardyman, 1984, page 196). The NRC staff is concerned that if detachment-type faulting is present at Yucca Mountain as has been reported by Scott (1986), then many unrecognized detachment surfaces may be present within the Tertiary section and there is potential for shattering of the units above the detachments. In addition, based on hydrofrac stress tests (Stock and others, 1985) normal faults on Yucca Mountain are at or close to a state of failure. If normal faults on Yucca are functionally associated with detachment surfaces, then the detachment along which they are connected may also be at or close to failure. Slip along a normal fault could then occur along a much more areally significant structure (i.e., the detachment) than previously believed. A discussion of the implications of this style of fault movement at Yucca Mountain is lacking in the final EA.

Comment 4

Hydrothermal Activity - (Draft EA Major Comment 2)

Guideline on Tectonics (10 CFR 960.4-2-7) (b), (C)(1)

NRC major comment 2 on the draft EA for Yucca Mountain raised the concern that the mean probability estimate for disruption of the repository by igneous or tectonic activity was not supported by the information provided in the draft EA. That probability formed much of the basis in the draft EA for the conclusion that there is less than one chance in 10,000 over the next 10,000 years of igneous activity or tectonic processes leading to release of radionuclides to the accessible environment. In addition, NRC major comment 2 raised the concern that the potential for hydrothermal activity, which is often associated with volcanic activity, was not considered in the draft EA. Examination of the final EA indicates recognition of current information which suggests that the probability of occurrence of a volcanic event at Yucca Mountain in the next 10,000 years could conservatively be estimated as exceeding one chance in 10,000 (final EA, Section 6.3.1.7.3, pages 6-262 and 6-263). However, the potential for associated hydrothermal activity and hence the potential for such activity to create new flow paths and adversely affect waste package corrosion and waste form dissolution is not addressed in final EA Volumes I and II and is inadequately addressed in final EA Volume III, Section C.5.7, pages C.5-41 and C.5-42.

Final EA Volume III, Section C.5.7 states that hydrothermal activity is thought to be an "unimportant contributor" to recent volcanic events near and at Yucca Mountain and further states that "should studies conducted during site characterization alter this perception, these processes will be considered." These comments indicate that hydrothermal activity is not recognized as a phenomenon needing study early in site characterization and overlook several lines of evidence suggesting that hydrothermal activity may have been present in the vicinity of Yucca Mountain during the Quaternary (Swadley et al., 1984) and may still be a factor in the area. Evidence suggesting hydrothermal activity includes: elevated water temperatures in drill holes near Yucca Mountain (draft EA, page 3-22; final EA, Section 3.2.4.1, page 3-23; Sass et al., 1980; Szabo and Kyser, 1985; Carr, 1982); hydrothermal alteration in rocks underlying the Paintbrush Tuff (draft EA, pages 6-216 and 6-217; final EA, Section 6.3.1.6.2, page 6-254 and Section 6.3.1.6.4, page 6-256); and calcite-silica vein deposits exposed in trenches CF1 (Swadley and Hoover, 1983) and 14 (DOE, 1986). If the latter are shown to be hydrothermal, they may indicate relatively recent upward movement of hydrothermal solutions. In addition, in the Wahmonie area, approximately 25 km east of Yucca Mountain, a subsurface granite mass was eliminated as a potential repository based, in part, on the presence of hydrothermal alteration and a spring deposit at that site (draft EA, page 2-14; final EA, page 2-14; Twenhofel, 1979).

Hydrothermal activity at the proposed Yucca Mountain repository site and the accompanying upward movement of heated waters could adversely affect waste isolation capabilities of the repository by opening new pathways for groundwater and the accompanying radionuclides to reach the accessible environment. The effects of the heated waters or vapors could also adversely affect performance of the waste package by significantly increasing corrosion rates of the waste package and dissolution rates of the waste form, resulting in more rapid waste package failure and in release of large amounts of radionuclides to the accessible environment earlier than calculated in the final EA.

Comment 5

Natural Resources Data Relevant to the Evaluation - (Draft EA Detailed Comment 6-94)

Guidelines on Human Interference 10 CFR 960.4-2-8 and Natural Resources 10 CFR 960.4-2-8-1(b)(1), (c)(1), (c)(4), (d)(2)

NRC staff detailed comment 6-94 on the draft EA for Yucca Mountain raised concerns that the analysis of historical mining and prospecting in the area of Yucca Mountain is not sufficient to assess economic potential inasmuch as natural resource exploration has been banned within the Nevada Test Site for over 30 years. Examination of the final EA indicates that several references have been added (Section 6.3.1.8.2, page 6-281, first paragraph; page 6-285, first paragraph; page 6-287, second paragraph) to show what work has been conducted at the Nevada Test Site in the past 30 years; however, arguments in support of the conclusion that "Yucca Mountain has no energy or mineral resources for which economic extraction is potentially feasible in the foreseeable future" (final EA, Section 6.3.1.8.4, page 6-288) do not recognize the direct knowledge currently available about natural resources at Yucca Mountain and overlook various indirect lines of evidence suggesting that there may be significant economic natural resource potential there. The NRC staff is concerned that the final EA does not recognize that the limited data base currently available permits alternate interpretations of the possibility of economically motivated postclosure human-interference activities that could adversely affect the isolation capabilities of the Yucca Mountain site.

None of the new references presented in the final EA support the conclusions cited in the preceding paragraph, although final EA Volume III, Section C.4.1.1, page C.4-7 and Section C.5.8, page C5-49 state that for natural resources "cores and cuttings... are routinely analyzed by geochemical methods...; no mineralization has been found of economic importance;" and that "field exploration and geologic mapping were conducted." To the NRC staff's knowledge no geochemical or geophysical data sufficient to delineate anomalies have been presented in reports on Yucca Mountain and vicinity. Conclusions related to mineral potential at the Yucca Mountain site are based on the studies of Bell and Larson (1982) and analyses of drill hole data presented in Maldonado and Koether (1983) and Spengler and others (1981) (final EA, Section 3.2.4, page 3-23). The contents of the reports by Maldonado and Koether (1983) and Spengler and others (1981) suggest those studies were conducted to determine the structure, stratigraphy, and petrographic features of local Tertiary volcanics and not necessarily for the purpose of resource assessment. Studies to assess natural resources should include assays, trace element analysis, and geophysical exploration methods. Surficial mapping, while of primary importance, is not sufficient to delineate "hidden" mineral deposits and must be combined with detailed geochemistry and geophysics.

Volume III, Section C.5.8, page C.5-50 of the final EA cites McKee (1979) as indicating that "of 98 mining districts in Nevada with $1 million or more production of gold, silver, copper, lead, zinc, mercury, antimony and iron, only 2 are within calderas, and only 5 are in silicic tuffs related to calderas" and that "93 percent of all the major metal-mining districts in the state are in rocks other than silicic tuff." These statements were used in the final EA (page C.5-50) to justify a negative correlation between calderas and ore deposits in Nevada. Of the five districts in tuffs identified by McKee (1979) it is important to note that three of the five (Divide, Goldfield, and Bullfrog) are within approximately 90 miles of Yucca Mountain and at one (Bullfrog, approximately 22 miles from the site) ores are associated with two lithologic units which are also present at the Yucca Mountain site, namely the Paintbrush and Timber Mountain Tuffs (Christiansen and others, 1977; McKee, 1979). Many ore deposits in Nevada in addition to those cited by McKee (1979) are associated with andesitic and rhyolitic tuffs. These include the Santa Fe, Rawhide, Borealis, Ivanhoe, Sixteen-to-One (Lowe and others, 1985) and two recent discoveries, Hog Ranch and Paradise Peak (Robert Schafer, Billiton Exploration, Pers. Comm.; Thomason, 1986). Therefore, although a significant correlation between mining districts and calderas cannot yet be demonstrated, a correlation can be shown between volcanic rocks, specifically silicic tuffs including units present at Yucca Mountain, and ore deposits in Nevada.

Yucca Mountain, due to its proximity to known mining districts (Bullfrog, 22 miles west; Bare Mountain, 10 miles northwest; Lee, 9 miles southwest; Amargosa, 6 miles southwest; Wahmonie, 12 miles east; and Mine Mountain, 15 miles northeast, (page 6-286, final EA)) could be interpreted as a possible exploration target. Of these mining districts, the Bare Mountain and Amargosa are still active and the Wahmonie and Mine Mountain are located within the Nevada Test Site. Reports on the Wahmonie area suggest that site may still be an "attractive" exploration target (Smith and others, 1983; Ponce, 1981; Hoover and others, 1982). Smith and others (1983) suggest that areas within the Bullfrog district may have bulk mineable gold potential. The Sterling Mine, in the Bare Mountain district and approximately 9 miles from Yucca Mountain, is currently in production with calculated gold reserves totaling $12 millon dollars ($350.00 oz. gold) (Smith and others, 1983; Lowe and others, 1985). Carr and Parrish (1985) suggest that Crater Flat may represent a caldera. If Crater Flat is a caldera, the Sterling Mine on the west side of Crater Flat may be located along a caldera rim suggesting that the potential for exploitable resources may also exist along the western flank of Yucca Mountain along what would be the eastern rim of the suggested Crater Flat caldera. Perceived potential, as well as known resources, should be assessed to determine the probability of post-closure human interference on or near the proposed Yucca Mountain site.

New techniques, models and methods for exploration and mining have evolved in the past 30 years since natural resource exploration was banned at the Nevada Test Site. For instance, the concept of bulk mineable gold deposits only began in the early 1960's with the discovery of the Carlin Mine. Also, the suggestion that an area has no economic potential if there exists no previous history of successful mining can be shown to be without merit. The recent large gold discovery at Hog Ranch in northwestern Nevada is located in an area with no nearby precious metal occurrences. In order to establish or conclude that an area is barren of exploitable economic deposits, detailed studies incorporating new techniques, models and methods would need to be conducted.

Many economic mineral deposits in Nevada are hydrothermal in origin with ore placement controlled by fault zones (Lowe and others, 1985). Possible hydrothermal deposits (NRC, 1984; DOE, 1986) have been recognized in fault zones at or near Yucca Mountain. Additionally, the proposed site is bounded on the west by the large Solitario Canyon fault which is characterized by a wide zone of highly brecciated rock. The ore at the Sterling Mine (east side of Bare Mountain) is located in breccia zones along a thrust fault and rocks which underlie the ore zone are silicified from hydrothermal fluids (Smith and others, 1983). Breccia zones within faults provide excellent conduits for ore placement by hydrothermal processes suggesting that the Solitario Canyon fault and other faults at or near the Yucca Mountain site should be thoroughly explored. The potential for undiscovered resources exists in these fault and possible hydrothermal zones. These geologic characteristics of the area at Yucca Mountain (Tertiary volcanics, possible hydrothermal, faults), taken in combination with the previously mentioned proximity to areas of economic resoures and the aforementioned lithologic and structural similarities of the Yucca Mountain area to areas hosting known mineral deposits, indicate a potential for undiscovered natural resources.

Comment 6

Radionuclide Transport Increase Due to Changes in Geohydrologic and Climatic Conditions - (Draft EA Major Comment 8)

Guidelines on Geohydrology 10 CFR 960.4-2-1(c)(1) and Climate Changes 10 CFR 940.4-2-4(c)(2)

In the NRC staff major comments on the draft EA for Yucca Mountain it was noted that although groundwater velocities may be substantially increased as a result of plausible future changes in geohydrology and climate, the significance of these changes relative to increased radionuclide transport was dismissed because of the implied ability of geochemical retardation to limit radionuclide transport to the accessible environment. The concern was raised that because the ability of the geochemical system to effect sufficient retardation is highly uncertain, it is not reasonable to assume significant increases in radionuclide transport to the accessible environment due to changes in climate or geohydrologic conditions will not occur at Yucca Mountain solely as a result of retardation. Examination of the final EA indicates that while increased flux and recharge during pluvial conditions is acknowledged and discussed thoroughly (Section 6.3.1.1.4, pages 6-141 to 142; Section 6.3.1.4.3, pages 6-233 to 6-239), the conclusion that geochemical retardation will limit radionuclide transport to the accessible environment to an extent that there would be no significant increase in transport of radionuclides to the accessible environment is maintained (Section 6.3.1.4.4, page 6-242) without indication that there has been a re-evaluation in light of that discussion.

Neither the guidelines nor the final EA presents a quantitative definition for the term "significant." However, a change in flux of less than one order of magnitude--plausible based upon final EA estimates that recharge rate at Yucca Mountain could increase by a factor of 15 over modern rates (final EA, Section 6.3.1.1.4, page 6-142)--can affect calculated velocity by more than one order of magnitude. Therefore, the NRC staff considers plausible future changes in climate and geohydrology as significant. This, coupled with existing and unresolved uncertainty in retardation (particularly the contribution of matrix diffusion: refer to Comment 8) leads the NRC staff to conclude that the concern expressed in the original major comment is still valid.

Comment 7

Groundwater Travel Time - (Draft EA Major Comment 3)

Guidelines on Geohydrology 10 CFR 960.4-2-1(d), (b)(1) and (b)(5)(iii)

In the NRC staff major comments on the draft EA for Yucca Mountain it was noted that because of a series of technical concerns identified during the review, DOE's confidence in calculated groundwater travel time, which was used with regard to findings concerning the disqualifying condition of 1000 years groundwater travel time and the favorable condition of greater than 10,000 years groundwater travel time, was questioned. Many assumptions, hypotheses, and approaches used in the analysis did not incorporate uncertainties associated with available data. For example, the possibility of fracture flow was not factored into the calculations; plausible alternative conceptual models of water migration through the unsaturated zone were not included in the analysis; and single values for key hydrologic parameters in the calculations were used rather than a range of values. In addition, it was noted that the conclusion that a geologic unit which would divert downward infiltration of water beyond the limits of emplaced waste is present was not supported adequately by information presented. Therefore, it was recommended that existing field and laboratory data and experiments, including those concerned with spatial and temporal variability of the hydrologic system at Yucca Mountain, as well as other sources of uncertainty, be considered in revised assessments of the groundwater travel time.

Examination of the final EA indicates that the original conclusion concerning diversion of downward infiltration away from the buried waste is no longer maintained (final EA, page 6-138, 3rd paragraph), because of a current lack of conclusively supporting information.

Further review of the final EA indicates that the analysis for groundwater travel time has been revised significantly in an attempt to incorporate uncertainties identified in the NRC staff major comment on the draft EA (NRC major comment 3 in Hydrogeology). For example, ranges in values for some hydrogeologic parameters are considered (final EA, Table 6-18) as well as the possibility of fracture flow. However, the NRC staff has concerns with the revised assessment for groundwater travel time in the areas of input data to the model and the subsequent statistical analyses. A brief description of specific problems that bear upon the findings in the final EA is given below.

1. Uncertainties affecting groundwater travel times--general: The computational procedures used in the final EA to generate a frequency distribution for predicted groundwater travel times can incorporate only the estimated uncertainties in those parameters input to the model as random variables. Uncertainties in those parameters treated as constants, uncertainty about the defensibility of the conceptual model, uncertainty about the validity of the boundary conditions, and uncertainty about some of the assumptions used in the mathematical flow model are not accommodated in the analysis which generated the frequency distribution for predicted groundwater travel times.

2. Uncertainties with parameters input to model as random variables: Probability distributions were estimated for hydrogeologic parameters treated as random variables (saturated matrix conductivity, porosity) by using subjective judgment and the results of tests on core specimens. However, the specific types of input distributions used to characterize the random variables are not listed in the final EA. This information may be contained in a supporting document cited in the final EA as Sinnock and others (1986), which was not available to NRC staff during review of the final EA. The NRC assumes, based on the range of data presented in Table 6-18, that the saturated hydraulic conductivity of the rock matrix was considered in the analysis to be lognormally distributed and that the porosity of the matrix was considered to be distributed in some type of symmetrical fashion (probably as a normal or uniform distribution). The NRC cannot evaluate these assumptions or considerations without listings of testing results and written documentation to support the parameter means and standard deviations reported in Table 6-18. There is also some confusion with the use or presentation of median and mean values of hydraulic conductivity in Table 6-18 (the given equation calculates median saturated hydraulic conductivity, but the results are given as mean saturated hydraulic conductivities), which may adversely affect use of data or interpretation of results for groundwater travel time.

3. Uncertainties Regarding Vertical Movement of Groundwater: Groundwater travel time values are critically dependent on whether matrix flow or fracture flow will dominate from the repository to the water table; that in turn depends primarily on three factors: (1) the vertical flux of water infiltrating from the repository to the water table, including the possibility of concentration of the flow along certain pathways; (2) the saturated hydraulic conductivity of the rock; and (3) the fraction of saturation at which flow changes from matrix to fracture flow. These three factors are elaborated upon below.

Flux

In the draft EA, the geometric mean saturated hydraulic conductivity of 1 mm/yr was used as the upper bound for flux for groundwater travel time calculations through the unsaturated zone. In NRC comments on the draft EA the choice of this value as an upper bound was considered to be inadequately supported and the suggestion was made that higher values be considered. In the final EA this value has been reduced to a constant value of 0.5 mm/yr (final EA, pages 6-150 to 6-153), a value supported by Wilson (1985), who uses two sources of information to arrive at this number: 1) data from in situ level of saturation values combined with capillary pressure-saturation data from Peters (1984); and 2) data from an empirical method of determining the ratio between recharge and precipitation rates in arid regimes.

The first of these methods appears to be reasonable, but the NRC is not able to verify independently the 0.5 mm/yr as a "conservative" upper bound because no other data are available. The second method, which also seems reasonable, suggests a wide range of possible recharge values at the Yucca Mountain site of between 0.45 and 1.5 mm/yr, which does not appear to support robustly the estimate of 0.5 mm/yr presented in the final EA. The NRC staff concludes that the uncertainty in the values of flux has not been adequately considered in the analysis of groundwater travel time.

The importance of taking into account uncertainties in flux values is emphasized by considering how a small change in flux affects groundwater travel times at Yucca Mountain. If the value of flux is less than the matrix saturated conductivity in the Topopah Spring unit, it is assumed that flow does not occur in the fractures, thereby resulting in a large (greater than 40,000 year) groundwater travel time. Conversely, if flux exceeds the saturated matrix conductivity in all rock units between the repository and the water table, fracture flow may result in relatively short groundwater travel times (less than 1000 years). As a specific example, if the flux is assumed to be 0.67 mm/yr rather than 0.5 mm/yr, then more than half of the model elements in the Topopah Spring welded unit would be expected to experience fracture flow, and the overall predicted groundwater travel times would be decreased considerably by this very slight increase in flux.

Another point related to uncertainties in flux values is that calculated groundwater travel time distributions are based on a one-dimensional model, restricted to the vertical dimension. All infiltration is assumed to occur uniformly across the vertical column. This does not allow for the possibility that there are preferential paths along which flow could concentrate. Phenomena such as "fingering" have been observed to occur in unsaturated porous media, leading to much faster movement of water in the vertical direction than would be indicated by uniform infiltration. Even a slight concentration of infiltration could significantly reduce groundwater travel time, because of its great sensitivity to flux. In this case, spatial uniformity in the lateral direction is the most optimistic assumption.

Saturated Hydraulic Conductivity

The NRC agrees in principle with the analysis of saturated hydraulic conductivity for matrix and fracture flow (final EA, pages 6-153 to 6-162). However, it must be recognized that the wide variation in saturated hydraulic conductivity values (0.03 to 14.2 mm/yr) reported by Peters et al., (1984) indicates that there may be significant zones in the Topopah Spring unit where the matrix saturated hydraulic conductivity is less than 0.5 mm/year. If such values occur throughout the entire depth of the unit, fracture flow could occur at flux values less than 0.5 mm/year thereby producing groundwater travel times of substantially less than 1000 years in certain areas of the Topopah Spring unit. Therefore, the possible spatial variability of saturated hydraulic conductivity must be adequately considered in combination with the uncertainty in the assumed value of flux in the analysis.

Transition between Matrix and Fracture Flow

The analysis in the final EA assumes that fracture flow is initiated when flux exceeds 95 percent of the saturated hydraulic conductivity of the rock matrix (final EA, page 6-153, last paragraph), but no rationale for this assumption is provided. The NRC is concerned about the justification for the use of this 95 percent value; furthermore, it is even more concerned that no sensitivity calculations were conducted (or at least none were reported) that would reveal the extent of the influence of choosing this percentage on the distribution of predicted groundwater travel times. Conceivably, this percentage could have been treated as a random variable in order to provide an analysis of uncertainty in the identification of the transition point from matrix flow to fracture flow.

4. Uncertainties related to intercorrelation of hydrogeologic properties: Hydrogeologic properties such as hydraulic conductivity and porosity are expected to be correlated; e.g., if porosity is larger, hydraulic conductivity is likely to be larger, all other things being equal. In addition, hydrogeologic properties are expected to be correlated spatially; e.g., measurements taken in close proximity are likely to be more similar than measurements separated by a large distance. Intercorrelations between hydrogeologic properties were not studied, evaluated, or used in the analysis of predicted groundwater travel time. Data sufficient for these more complicated studies may not exist; however, an effort to describe, at least subjectively, the probable intercorrelations and spatial correlations among the hydrogeologic parameters could have been made. By so doing, the potential effects of these correlations and intercorrelations on groundwater travel time predictions could have been evaluated. This might be especially important in the case of the vertical spatial correlation of saturated hydraulic conductivity, discussed further in the following section (#5).

5. Uncertainties in methods of analyzing groundwater travel times: The analysis of groundwater travel time in the final EA relied on a model, Method 1, in which the vertical layer spacing was 10 ft (final EA, page 6-153, third paragraph). The final EA also presents a second analysis for groundwater travel time, Method 2, (final EA, page 6-160, last paragraph) in which each hydrogeologic unit (some of which are hundreds of feet thick) represents one layer. The claim is made that Method 2 is more conservative than Method 1 because "as more physical realism is introduced into the travel time model, the range of travel times is likely to be compressed. Moving from Method 2 to Method 1 clearly has the effect of removing the low probability, extreme values in the tails of the frequency distribution of travel times from the disturbed zone to the water table" (final EA, page 6-162, third paragraph). The final EA concludes that Method 2 gives a more conservative groundwater travel time for small percentiles of the cumulative distribution function (CDF). On the other hand, Method 1, which is supposedly more realistic, suggests that there is only a low probability that the groundwater travel time is less than 10,000 years.

   These conclusions reached on the comparison of the results of Methods 1 and 2 in the final EA (Figure 6-9, page 163) are questionable. The stated increase in realism of Method 1 over Method 2 is probably a mathematical artifact. It can be demonstrated that as the layer thickness is diminished (as it is in Method 1 vis-a-vis Method 2), and if the properties of the layers remain spatially uncorrelated (as they are in Method 1), the groundwater travel time would approach a constant for each vertical column. Given this artificially-induced compressive effect, Method 2 is in fact more likely to encompass the correct distribution than Method 1.

6. Uncertainties in use of simulated groundwater travel time distributions: The NRC staff is concerned with how the distribution of groundwater travel time was used to evaluate the conclusions regarding travel times in the final EA. The conclusions were based on central tendencies (mean and median) of the simulated groundwater travel time distribution. Analyses using percentile criteria smaller than the mean or median would more properly reflect the high degree of uncertainty present in the groundwater travel time distribution.

   In support of the analyses leading to groundwater travel times in excess of 10,000 years, the final EA states (page 6-131, second paragraph) that "the extreme upper and lower portions of the travel time distribution are characteristic of travel times along unlikely paths of radionuclide travel, and therefore, inappropriate for evaluating this favorable condition (10,000 year groundwater travel time). The DOE considers this judgment to be consistent with the NRC staff position regarding the groundwater travel time requirement in 10 CFR Part 60-(Browning, 1985)." Although the NRC does anticipate excluding the extremes of the distribution of possible groundwater travel times in determining whether the performance objective has been met, excluding the tails (extremes) of a distribution is not equivalent to a choice of the mean or median as the measure of the groundwater travel time. This is particularly so for initial screening prior to site characterization, where attempting to reach conclusions about "likely" and "unlikely" flow paths is speculation at best. Indeed, eliminating the tails of the groundwater travel time distribution virtually requires ignoring the uncertainty that the analyses were intended to incorporate. In addition, the mean or median may be particularly poor choices of a criterion for the groundwater travel time distribution because of their relative insensitivity to modeling assumptions such as sampling methods and spatial correlations. The meaning of the NRC statement (Browning, 1985) that refers to excluding extremes is simply that the NRC might consider the performance objective to be met even if some small portion of the distribution was less than the time criterion (e.g., 1000 years), assuming the conceptual model and other determining factors behind the distribution itself are defensible.

Comment 8

Retardation of Radionuclides

Guideline on Geochemistry (10 CFR 960.4-2-2): (b) Favorable Conditions 2, 5

In the NRC staff major comment 6 on the draft EA for Yucca Mountain, the concern was raised that the retardation factors used in determining radionuclide releases were inappropriately large in assessing the effectiveness of geochemical processes affecting radionuclide retardation. In the final EA two mechanisms--matrix diffusion and sorption--are described which, if operative in the repository system, would diminish radionuclide releases to the accessible environment. In response to the NRC major comment on the draft EA, new evidence is presented in the final EA to support the position that matrix diffusion and sorption will play an important role in controlling radionuclide release. However, the NRC staff considers that the new evidence inadequately supports the conclusion that retardation of several key actinides by these mechanisms will occur.

Retardation of radionuclides by matrix diffusion in the fractured rock of Yucca Mountain is described in the final EA (Section 6.3.1.2.3.(2), page 6-177) and supported by the final EA reference (Travis et al., 1984). In this reference it is shown that in a fractured rock with low matrix permeability and interconnected pores, retardation factors can be as large as 400 for nonsorbing species and several thousand for sorbing species when these species are in solution. From the description in Travis et al. (1984) the fractured rock studied may be analogous to the reference repository host rock, the Topopah Spring Member. However, the scenario described in this reference does not consider how radionuclide release would be affected if the radionuclides were present as colloids or pseudocolloids rather than dissolved species. Based on the comparison of individual radionuclide inventories versus their EPA limits at 1000 years, the important radionuclides of nuclear waste are actinides (Kerrisk, 1985). The actinides, when leached from a glass waste form, are expected to occur as colloids (final EA, Section 6.3.1.2.3.(2), page 6-189); therefore, the effect of colloids on matrix diffusion in fractured rocks needs to be considered when evaluating how much credit can be taken for retardation by this mechanism.

The final EA does describe how radiocolloids can contribute to retardation in rocks in which porous flow will occur, such as the unsaturated tuffaceous beds of the Calico Hills unit, by being mechanically filtered from the flowing liquid (Section 6.3.1.2.3.(2), page 6-191). The final EA proposes that mechanical filtration will occur because some of the colloids will be bigger than some of the pores through which the fluid is flowing. However, if colloids are present in the fluids flowing through fractured rock, two scenarios are possible that could lessen the effectiveness of matrix diffusion for retarding radionuclide transport:

1. Colloids, which can range in size up to 10 μm (Stumm and Morgan, 1981), might be too large to pass into the pores of the matrix. In such cases, colloids would remain in the fluid flowing in the fractures and retardation would be decreased.

2. Colloids, partly because of their large size, can have diffusivities several orders of magnitude lower than those of dissolved ions in water (Weast, 1971). Therefore, compared to ions, large particles such as colloids will have much less tendency to diffuse into the matrix (Cathles et al., 1974).

In the final EA, sorption is the second mechanism given credit for retarding the release of radionuclides from the repository. In response to the NRC major draft EA comment regarding sorption, the final EA refers to new data from Rundberg (1985) which suggests that for simple cations (Sr, Cs, and Ba) sorption parameters determined from batch tests using crushed solids are in good agreement with sorption parameters obtained from corresponding tests with intact solids. The NRC staff finds this information unconvincing for the following reasons:

1. According to Kerrisk (1985), the important radionuclides in nuclear waste are not the simple cations listed above but instead are the actinides such as Am, Pu, U, and Np which can exist in more than one form (simple ions, complex ions, and colloids) in groundwater. Nyhan et al. (1985) present field evidence for multiple forms of actinides in groundwater below a liquid waste disposal site where significant quantities of Pu and Am were mobilized when water was allowed to flush through the system. Kelmers (1984) describes how sorption parameters from batch tests only average the sorption of the multiple species of a given radionuclide. The sorption parameter underestimates the amount of sorption for the strongly sorbed species but overestimates the amount of sorption for the weakly sorbed species.

. Rundberg (1985) does not attempt to correlate between sorption parameters
r actinides derived from tests using crushed and intact rock. In fact, he
tates that for americium and plutonium "the sorption mechanism is not known
r is the chemical form of plutonium and americium in neutral pH solutions
own with any certainty" (Rundberg, 1985, page 19). This implies that at this
ime no meaningful correlation between the batch experiments on crushed tuff in
e laboratory and the field situation with the intact tuff would be possible.

. No correlation is apparent in Rundberg's experiments between the amount of
tinide sorbed and the proportion of sorbents (zeolites and clays) in the
lids. Therefore, zeolites and clays have not been shown to be effective
rbers of Pu and Am.

Rundberg (1985) states that precipitation, which would yield an apparent
rption ratio, cannot be ruled out in the batch measurements. If
ecipitation instead of sorption has occurred in the batch test, retardation
not proven. In such a case, concentration of a radionuclide species in the
lution would be limited by the solubility of the radionuclide-bearing solid
d insensitive to the presence of the other solids in the substrate. For
ample, if precipitation occurred in a batch test using a nonsorptive solid
d a radionuclide-bearing solution, an "apparent sorption ratio" could be
termined. This "apparent sorption ratio" could be erroneously inserted into
e equation for calculating the retardation factor. However, if the liquid
om the batch test was then decanted into a column containing the same
nsorptive solid, the concentration would be below the solubility limit (i.e.,
additional precipitation would occur) and the radionuclide would travel down
e column as fast as the liquid (no retardation). Thus, if precipitation is
t disproved in a sorption test, credit cannot be taken for retardation of the
dionuclide.

ven these concerns with the new information introduced in the final EA to
pport the assessments of geochemical factors affecting radionuclide
ansport, the NRC staff is concerned that those assessments do not fully
cognize the uncertainties in the data currently available.

mment 9

ste Package Post-Closure Performance - (Draft EA Major Comment)

idelines on Post-Closure 10 CFR 960.4-1, 960.4-2-1(a) and 960.4-2-2(a)

the NRC major comment 10 on the draft EA for the Yucca Mountain site the
ncern was raised that the performance analysis of the engineered barrier
stem was based on insufficiently supported assumptions concerning waste
ckage failure modes and radionuclide release rates and that the uncertainties
sociated with the assumptions were not adequately conveyed. The comment
ggested that the final EA consider more realistic assumptions in the
ference case preliminary performance analysis and provide an estimate of the

impact of uncertainties on the result of the analysis or reconsider the summary statements made in the draft EA. Examination of the final EA (Executive Summary, Section 6.2, page 18, third paragraph; Section 6.4.2, pages 6-364 to 6-388) indicates that some revisions have been made to identify areas of uncertainty which are to be addressed during site characterization (Sections 6.4.2.1.1, page 6-367, paragraph 3, and 6.4.2.2.2, page 6-374, first paragraph); however, the consequences of the current uncertainties on the analyses of waste package lifetime and radionuclide release rate have not been addressed and hence there is limited recognition that the current data base permits alternative analyses.

Although the final EA may imply that the assumptions used to make evaluations regarding the engineered barrier system are the best estimate of realistic conditions based on the current DOE data (Sections 6.4.2.2.1, page 6-372, first full paragraph, and 6.4.2.2.2, page 6-373, first paragraph), many of the assumptions are currently unsubstantiated and the range of uncertainties not considered when making the evaluations. For example, while it may be true that corrosion testing performed for the last couple of years in a Yucca Mountain simulated environment has not yet identified an operable corrosion mechanism other than uniform attack (Section 6.4.2.1.1, page 6-369, continuing paragraph), the historical susceptibility of the austenitic stainless steels to stress-assisted cracking in chloride/oxygen/water (steam) environments raises significant questions as to their long-term performance. Furthermore, based on the recent test results contained in NUREG/CR-4619, which indicate evidence of crack initiation for a range of simulated Yucca Mountain environments, the NRC staff cannot at this time accept a 3000 year container life as a realistic or conservative value. Until the prediction of the waste package lifetime is justified and the effects of input parameter and model uncertainties are accounted for, the possibility exists that the current analysis in the final EA may greatly overestimate the waste package lifetime.

The NRC staff is also concerned that the efforts made in the text of the final EA to more fully acknowledge the uncertainties in the analyses were not reflected in the discussion contained in the Executive Summary. In fact, the parenthetical sentence contained in the draft EA Executive Summary (op. cit.):

> "There is an issue as to the rate of corrosion in the unsaturated zone; it will be addressed further during site characterization;"

was deleted in the final EA, thereby strengthening the implication that a 3000 year containment lifetime is both realistic and conservative.

NRC staff concerns regarding waste package performance modeling and the effects of input parameters and model uncertainties on the waste package lifetime predictions have not been alleviated in the revision of the draft EA. The NRC staff considers that major comment 10 applies to the final EA.

REFERENCES

Abraham, T., H.Jain, P. Soo, Brookhaven National Laboratory, "Stress Corrosion Cracking Tests on High-Level-Waste Container Materials in Simulated Tuff Repository Environments," USNRC Report NUREG/CR-4619, June 1986.

Bell, E. J., and L. T. Larson, 1982. Overview of Energy and Mineral Resources for the Nevada Test Site, Nye County, Nevada, NVO-250, Nevada Operations Office, U.S. Department of Energy, Las Vegas, 67 p.

Browning, R.E., 1985, letter to R. Stein (DOE), June 12, 1985, regarding NRC position on groundwater travel time.

Carr, W.J., 1982. Volcano - Tectonic History of Crater Flat, Southwestern Nevada, as Suggested by New Evidence From Drill Hole USW-VH-1 and Vicinity, USGS-OFR 82-457, Open File Report, U.S. Geological Survey, Denver, CO, 23 p.

Carr, W.J., 1984. Regional Structural Setting of Yucca Mountain, Southwestern Nevada, and Late Cenzoic Rates of Tectonic Activity in part of the Southwestern Great Basin, Nevada and California, USGS-OFR 84-854, 109 p.

Carr, W. J., and L. D. Parrish, 1985. Geology of Drill Hole USW VH-2, and Structure of Crater Flat, Southwestern Nevada, USGS-OFR 85-475, 41 p.

Cathles, L. M., H. R. Spedden, and E. E. Malouf, 1974, "A Tracer Technique to Measure the Diffusional Accessibility of Matrix Block Mineralization," in Solution Mining Symposium 1974, Editors F. F. Aplan, Society of Mining Engineers, American Institute of Mining, Metallurgical and Petroleum Engineers, New York.

Christiansen, R. L., P. W. Lipman, W. J. Carr, F. M. Byers, Jr., P. P. Orkild, and K. A. Sargent, 1977. "Timber Mountain - Oasis Valley Caldera Complex of Southern Nevada," Geological Society of America Bulletin, V. 88, p. 943-959.

DOE (U.S. Department of Energy), 1986. Final Summary of Workshop on Fault-Related Calcite - Silica Deposits Near Yucca Mountain, April 28, 1986.

Hardyman, R.F., 1984, Strike-slip, normal and detachment faults in the northern Gillis Range, Walker Lane of West-Central Nevada; in Hardyman, R.F., Ekren, E.B., and Proffett, J., 1984, Tertiary tectonics of west-central Nevada: Yerington to Gabbs Valley: Western Geological Excursions, v. 4, p. 184-199.

Healy, J.H., S.H. Hickman, M.D. Zoback, and W.L. Ellis, 1984. Report on Televiewer Log and Stress Measurements in Core Hole USW-G-1, Nevada Test Site December 13-22, 1981, USGS-OFR 84-15, 47 p.

Hoover, D. B., M. P. Chornack, K. H. Nervick, and M. M. Broker, 1982. *Electrical Studies at the Proposed Wahmonie and Calico Hills Nuclear Waste Site, Nevada Test Site, Nye Co., Nevada*, USGS-OFR 82-466, 45 p.

Kelmers, A. D., 1984, Draft Analysis of Conservatism of Radionuclide Information Measured by Batch Contact Sorption/Apparent Concentration Limit Isotherms, Letter Report L-290-3 to the NRC.

Kerrisk, J. F., 1985, "An Assessment of the Important Radionuclides in Nuclear Waste," LA 10414 MS.

Knauss, K. G., 1981. *Dating Fault Associated Quaternary Material from the Nevada Test Site Using Uranium-Series Methods*, Lawrence Livermore Laboratory, UCRL-53231, 51 p.

Lowe, N. T., R. G. Raney, and J. R. Norberg, 1985. *Principal Deposits of Strategic and Critical Minerals in Nevada*, U.S. Bureau of Mines Information Circular 9035, 201 p.

Maldonado, F., 1985. "Geologic map of the Jackass Flats area, Nye County, Nevada," *U.S.G.S. Miscellaneous Investigations Map I-1519*.

Maldonado, F., and S.L. Koether, 1983. *Stratigraphy, Structure, and Some Petrographic Features of Tertiary Volcanic Rock at the USW G-2 Drill Hole, Yucca Mountain, Nye County, Nevada*, USGS-OFR 83-732, 83 p.

McKague, H.L., and P.P. Orkild, 1984. "Geologic Framework of Nevada Test Site," *Geological Society of America Abstracts with Programs*, v. 16, no. 6, p. 589.

McKee, E.H., 1979. "Ash Flow Sheets and Calderas: Their Genetic Relationship to Ore Deposits in Nevada," *Geological Society of America Special Paper 180*, p. 205-211.

NRC, Trip Report, December 1984, Comments on Data Review, B. Rice and J. Cutler.

Nyhan, J. W., B. J. Drennon, W. V. Abeele, M. L. Wheeler, W. D. Purtymun, G. Trujillo, W. J. Herrera, and J. W. Booth, 1985, "Distribution of Plutonium and Americium Beneath a 33-year-old Liquid Waste Disposal Site," *Journal of Environmental Quality*, vol. 14, 501-509.

Peters, R.R., Klavetter, E.A., Hall, I.J., Blair, S.C., Heller, P.R., and Gee, G.W., 1984, "Fracture and matrix hydrologic characteristics of tuffaceous materials from Yucca Mountain, Nye County, Nevada," Sandia National Laboratories, Albuquerque, NM, SAND84-1471.

Ponce, D.A., 1981. *Preliminary Gravity Investigations of the Wahmonie Site, Nevada Test Site, Nye County, Nevada*, USGS-OFR 81-522, 63 p.

Rundberg, R. S., 1985, "Assessment Report on the Kinetics of Radionuclide Adsorption on Yucca Mountain Tuff," Los Alamos National Laboratory, Los Alamos, NM.

Sass, J.H., A.H Lachenbruch, and C.W. Mase, 1980. *Analysis of Thermal Data From Drill Holes UE 25a-3 and UE 25a-1, Calico Hills and Yucca Mountain, Nevada Test Site*, USGS-OFR 80-826, Open File Report, U.S. Geological Survey, Menlo Park, CA., 25 p.

Scott, R.B., 1986. "Extensional Tectonics at Yucca Mountain, Southern Nevada," *Geological Society of America Abstracts with Programs*, v. 18, no. 5, p. 411.

Scott, R.B., and J. Bonk, 1984. *Preliminary Geologic Map of Yucca Mountain, Nye County, Nevada with Geologic Sections*, USGS-OFR 84-494, Scale 1:12,000.

Scott, R.B., and J.G. Rosenbaum, 1986. "Evidence of Rotation About a Vertical Axis During Extension at Yucca Mountain, Nevada," *EOS*, v. 67, no. 16, p. 358.

Sinnock, S., Lin, Y.T., and Tierney, M.S., 1986, Preliminary Estimates of Groundwater Travel Time and Radionuclide Transport at the Yucca Mountain Repository Site," Sandia National Laboratories, Albuquerque, NM, SAND85-2701.

Smith, P.L., J.V. Tingley, J.L. Bentz, L.J. Garside, K.G. Papke, and J. Quade, 1983. *A Mineral Inventory of the Esmeralda - Stateline Resource Area, Las Vegas District, Nevada*, Nevada Bureau of Mines and Geology, OFR 83-11.

Spengler, R.W., F.M., Byers, Jr., and J.B. Warner 1981. *Stratigraphy and Structure of Volcanic Rocks in Drill Hole USW-G1, Yucca Mountain, Nye County, Nevada*, USGS-OFR 81-1349, 50 p.

Stock, J.M , J.H. Healy, S.H. Hickman, and M.D. Zoback, 1985. "Hydraulic Fracturing Stress Measurements at Yucca Mountain, Nevada and Relationship to the Regional Stress Field," *Journal of Geophysical Research* v. 90, no. 10, p. 8691-8706.

Stumm, W. and J. J. Morgan, 1981, *Aquatic Chemistry: An Introduction Emphasizing Chemical Equilibria in Natural Waters*, 2nd Ed., John Wiley, p 647.

Swadley, W.C. and D.L. Hoover, 1983. *Geology of Faults Exposed in Trenches in Crater Flat, Nye County, NV,* USGS-OFR 83-608, U.S. Geological Survey, Denver, CO, 15 p.

Swadley, W.C., D.L. Hoover, and J.N. Rosholt, 1984. *Preliminary Report on Late Cenozoic Faulting and Stratigraphy in the Vicinity of Yucca Mountain, Nye County, NV*, USGS-OFR 84-788, U.S. Geological Survey, Denver, CO, 42 p.

Szabo, B.J., and T.K. Kyser, 1985. Uranium, Thorium Isotopic Analyses and Uranium - Series Ages of Calcite and Opal, and Stable Isotopic Compositions of Calcite From Drill Cores UE 25a#1, USW G-2, and G-3/GU-3, Yucca Mountain, NV, USGS OFR 85-224, U.S. Geological Survey, Denver CO, 25 p.

Thomason, R.E., 1986. "Geology of the Paradise Peak Ore Deposit," Geological Society of Nevada, May, 1986, Meeting Announcement.

Travis, B.J., S.W. Hodson, H.E. Nuttall, T.L. Cook and R.S. Rundberg, 1984. Preliminary Estimates of Water Flow and Radionuclide Transport in Yucca Mountain, LA-UR-84-40 (Rev.), Los Alamos National Laboratory, Los Alamos, NM

Twenhofel, W.S., 1979. Letter from W.S. Twenhofel (USGS) to R.M. Nelson (DOE/NVO), April 24, 1979; regarding technical findings on southwest quadrangle, 5 p.

U.S.G.S., 1984. A Summary of Geologic Studies Through January 1, 1983, of a Potential High-Level Radioactive Waste Repository Site at Yucca Mountain, Southern Nye County, Nevada, USGS-OFR 84-792, 103 p.

Weast, R. C., 1971, Handbook of Chemistry and Physics, 51st Ed., The Chemical Rubber Company, F-47 and F-199.

Wilson, W.W., 1985, letter to D.L. Vieth (DOE/NVO), December 24, 1985, regarding flux in the unsaturated zone.

MAJOR COMMENTS

ON

DAVIS CANYON SITE

Comment 1

Structure and Tectonics - (Draft EA Major Comment 1)

Guideline on Tectonics 10 CFR 960.4-2-7 (a),(b),(c)(4), and 10 CFR 960.5-2-11 (c)(3)

In major comment 1 of the NRC review of the draft EA for Davis Canyon, concerns were raised regarding incomplete evaluations of information and uncertainties with respect to the (1) tectonic regime in the site region, (2) subsurface structures (i.e., joints, fractures) and (3) major structural features in the site vicinity (e.g., Imperial fault, Chesler Canyon). Examination of the final EA indicates that these concerns have not been adequately addressed for the reasons discussed below.

With respect to the NRC concern that the site is in a region of active tectonism (item 1), the final EA presents a discussion of seismicity in an area along the Colorado lineament and in the vicinity of Shay Graben in Section 3.2.5.2 and in Section 6.3.1.7.1. The final EA states that "Concentrated microearthquake activity extending approximately 50km along the (Colorado) river southwest from Moab appears to reflect reactivation of a fault or faults within the lineament" (page 3-62). The final EA acknowledges that "microearthquakes have been observed in the vicinity of the Shay Graben faults," but qualifies this by stating that "the uncertainty of their locations precludes correlating these events definitely with the Shay Graben faults" (page 3-63). The final EA does not discuss the possibility that the Sweet Alice graben and the Dark Canyon fault are part of a southwestern extension of the Shay/Bridger Jack/Salt Creek graben system and that, if so, a more significant, active seismotectonic zone may be present in the site area. This could lead to a higher value for the maximum credible earthquake for this zone than is given in the final EA.

An additional concern emerges from new data presented in Figure 3-30 of the final EA which indicate a swarm of microearthquakes to the southwest of the site in the vicinity of the Imperial Fault zone that are not discussed in the evaluation of tectonics. Such activity is a source of uncertainty not incorporated into the evaluation of active tectonism.

Finally, also in regard to item 1 of the NRC concerns, an apparent discrepancy was noted regarding the relationship of the main basin-bounding fault in the Lockhart basin and Quaternary alluvial deposits adjacent to it. On page 3-58 of the final EA, it is stated that alluvial deposits overlie the fault without displacement suggesting a lack of fault movement during Quaternary time. However, on page 3-71 it is stated that Quaternary alluvial deposits are ponded on the southeast side of the fault. This raises the possibility of fault movements during Quaternary sedimentation.

Item 2 of the NRC concerns on the draft EA involves the incomplete information presented in the draft EA regarding subsurface structures in the site vicinity. The final EA contains an expanded discussion of subsurface structures in the vicinity of Shay graben and the Lockhart basin in Section 3.2.5.1. The final EA also contains a new discussion on jointing (Section 3.2.5.7). The data presented are based largely on air photo analysis and, as the final EA states, "air photo analysis does not provide adequate information to evaluate the age of jointing, its sequence, or its vertical continuity" (page 3-79). Given these limitations, the NRC staff considers that reliance on air photo analysis as partial support for the observation that "there is no evidence at the surface or in well logs of two boreholes located at the crest of the (Gibson) dome that joints have acted as conduits for groundwater to reach the salt, causing dissolution" (page 3-73) does not reflect the uncertainty or the data base.

The third concern expressed by NRC involved the apparent lack of recognition of the Imperial fault zone and northwest-trending structures in the area of Chesler Canyon, and the lack of an evaluation of these features with respect to the tectonic regime. As suggested in the NRC comment 1 on the draft EA, the final EA addressed the following structural features: the Meander anticline (Section 3.2.5.5), the Needles fault zone (Section 3.2.5.1), the north-northwest-trending salt anticlines and smaller parallel structures including Gibson dome, Rustler dome, and the Indian Creek syncline (Section 3.2.5.5), the valley anticlines (Section 3.2.5.4), the northwest-trending faults that run parallel to or within the core of salt anticlines (Section 3.2.5.1) and the northeast-trending faults (Section 3.2.5.1). Regarding the Imperial Fault zone and Chesler Canyon, however, the NRC staff was not able to locate any discussion of these features in the final EA. The Imperial Fault zone may be of special significance because the swarm of microearthquakes recently observed southwest of the site, and referred to above, is located at the eastern extension of this zone, thus suggesting the possibility of recent fault movement in this zone.

Comment 2

Dissolution - (Draft EA Major Comment 2)

Guideline on Dissolution 10CFR960.4-2-6 (a) and (b)

In the NRC staff major comments on the draft EA for Davis Canyon, NRC raised the following concerns related to dissolution:

1) limited seismic reflection coverage coupled with discontinuous salt reflector data in the site vicinity;
2) possibility that faulting has disrupted the evaporite sequence bringing the water-bearing Mississippian strata in contact with the salt sequence;
3) aeromagnetic anomalies coincident with anomalous areas on orthophotos and Landsat imagery near fault R and near Lavender Canyon;
4) data not presented on joints and fractures which could provide

pathways for fluid migration;
5) possibility that limestone units could contain cavities, fractures or collapse features that would allow groundwater to contact salt;
6) small, active dissolution features that may have gone unnoticed in examination of well logs;
7) Leadville Formation water chemistry at GD-1 indicating salt dissolution which may be local; and
8) use of non-site-specific rates of dissolution.

Examination of the final EA has led NRC staff to consider that there no longer exist major concerns regarding the treatment in the final EA of items 6 and 8, but the staff continues to have major concerns with the remaining items as discussed below.

NRC's first concern, limited seismic reflection coverage, is acknowledged in Section 3.2.5.1, page 3-56 and Section 6.3.1.6, pages 6-157 and 6-158 and discontinuous reflector data between surface faults and Mississippian strata is mentioned on page 6-157. On page 6-157 of the final EA for Davis Canyon, it is stated that the resolution of the gravity surveys made for the EA's is 3.2 km (2 mi), and that even major features such as Shay Graben cannot be resolved given the regional gravity survey station coverage. Therefore, the possibility of dissolution along a feature such as fault R cannot be conclusively determined by available gravity data. The limitations in both the seismic reflection and gravity data make determinations of the continuity of subsurface features difficult or impossible to achieve at this time. For this reason, the NRC staff considers the statement on page 6-159 of the final EA "Within the limitations of the data...there is no evidence of Quaternary or earlier dissolution within the site" (emphasis added) does not sufficiently reflect the possible significance of the discontinuous salt reflectors and the severe inadequacy of existing seismic reflection coverage.

The second NRC concern, contact between Mississippian strata and salt units, was discussed with respect to fault R in Section 6.3.1.6, page 6-157. The final EA concluded that because the combined thickness of the Molas and Pinkerton Trail formations is 110 meters and the interpreted maximum displacement along Fault R is 80 meters, there is no juxtaposition of the limestone units and the Paradox salts along Fault R. However, because of the proximity of Fault R to the site and because of uncertainties regarding the thicknesses of the Molas and Pinkerton Trail and the maximum amount of offset along Fault R, the NRC staff continues to be concerned that faulting may have resulted in exposure of salt units to unsaturated groundwater, resulting in dissolution. Furthermore, interpretations of geophysical data in Kitcho et al. (1984) by the State of Utah High Level Nuclear Waste Office (1986) suggest that the number of faults identified in the site area appears to be proportional to the seismic coverage, and that on the basis of their interpretation of seismic reflection and aeromagnetic surveys, at least two additional faults may be present at the site. If additional faults are present at the site, there is the possibility of groundwater movement along these zones that could lead to dissolution of the salt.

The third NRC concern is related to coincidence of aeromagnetic anomalies and orthophoto anomalies noted during the NRC geophysics data review with DOE on October 18, 1984. Other geophysical data are discussed on pages 6-156 and 6-157 where the final EA cites Kitcho et al., 1984 in stating that "in the vicinity of Davis Canyon, no gravity anomalies were observed that would indicate significant subsurface geologic structures." However, the final EA does not discuss the NRC concerns with aeromagnetic anomalies and the possibility that they may represent previously unrecognized subsurface structures. Furthermore, in the recent report from the State of Utah High Level Nuclear Waste Office (1986), it is stated that "aeromagnetic surveys indicated that faults are present in Davis Canyon." Therefore, the possible significance of the aeromagnetic anomalies with respect to both subsurface structures and dissolution continues to be a concern to the NRC.

The NRC's fourth comment regarding pathways for fluid migration along joints and fractures is addressed in Sections 3.2.5.7, page 3-73 and 3.3.2.1, pages 200, 202, and 204 of the final EA. It is stated on page 3-73 that "There is no evidence at the surface or in well logs of two boreholes located at the crest of the (Gibson) dome that joints have acted as conduits for groundwater to reach the salt, causing dissolution." While we agree that there is no conclusive evidence of large-scale deep dissolution in the Paradox in the Davis Canyon area, geochemical and hydrologic head data suggest the potential for deep dissolution within this area. Figure 3-57 (page 3-198) indicates that Leadville Formation waters are undersaturated and Figure 3-60 (page 3-203) indicates that head potentials in the Leadville Formation are significantly higher than those measured in the Paradox. Therefore, it is possible that water from the Leadville could move upward through any fracture systems in the Molas and Pinkerton Trail formations and come into contact with Paradox Formation salts. Such deep dissolution could be well advanced and result in significant disruption of the Paradox Formation before surface effects such as the Lockhart Basin would appear.

NRC's fifth comment regarding cavities in the limestone units is addressed in Section 3.2.5.7, pages 3-72 and 3-73. The final EA states that the probability of occurrence of cavities allowing connection between limestone and salt is low "since there is no known evidence for such an occurrence in the geologic setting" (page 3-73). However, the final EA acknowledges that geophysical data are very limited and dissolution features smaller than 31 meters of vertical dissolution over an area of 2.6 square km. probably would go undetected with present surface mapping techniques. The NRC staff considers that, given the limitations in the geophysical data and the fact that a karst cavity was encountered in the Leadville limestone in a petroleum exploration borehole, it is possible that additional cavities probably exist, some of which may allow hydrologic interconnection between the Leadville and the overlying Paradox Formation salts.

The NRC's seventh concern regarding high total dissolved solids (TDS) in the Leadville Formation in GD-1 is discussed in Section 6.3.1.6.1, page 6-158. The final EA indicates that the high TDS may not result from local dissolution by modern, meteoric waters but rather the source of the high TDS may be the dissolution in the Lockhart Basin. The NRC, however, considers that the limited data available on the source of the high TDS does not preclude the possibility of active, localized dissolution.

Comment 3

Groundwater Travel Time - (Draft EA Major Comment 3)

Guideline on Geohydrology 10 CFR Part 960.4-2-1(b)(1)

The NRC staff major comment on the draft EA for the Davis Canyon site stated a general concern that many of the assumptions and approaches used in the groundwater travel time analysis were not conservative and did not incorporate appropriate uncertainties. In support of the major comment, the NRC staff cited several detailed comments describing specific concerns with respect to the conceptual model, flow path, vertical and horizontal hydraulic gradients, and porosity as follows. Potentially faster flow paths, such as through interbeds and along structural discontinuities, may exist as compared with the single pathway used in the evaluation. The occurrence of fracture flow was recognized but not used to bound the travel time estimate. The lateral gradient provided in the draft EA for the Leadville Limestone was not conservative based on available potentiometric head data. The presence of a downward gradient in the host rock and immediately surrounding units was not adequately demonstrated by the available data. Porosity data used in the evaluation were not conservative with respect to the available data. Conceptual and numerical models used to support the travel time estimates contained uncertainties that were not carried through to bound the travel time estimate. The travel time calculation did not consider that the size of the disturbed zone and size of the controlled area determine distance to the accessible environment. In addition, flow rates calculated for the Leadville Limestone as used in the travel time calculation contained an arithmetic error.

Examination of the Davis Canyon final EA indicates that the analysis for groundwater travel time has been revised significantly in attempting to incorporate uncertainties identified in the NRC staff major comment on the draft EA. A substantial degree of uncertainty and conservative assumptions are incorporated quantitatively into the new groundwater travel time calculations. Ranges of values for some hydrogeologic parameters are considered, as well as groundwater flow through permeable interbeds or along fracture zones Environmental heads are used to calculate vertical hydraulic gradients and upward as well as downward hydraulic gradients across the host salt are also considered. In portraying uncertainty related to present knowledge of the Davis Canyon site groundwater flow system, the final EA presents simulated groundwater travel time distributions for both porous media and fracture flow (Section 6.4.2.3.5, pages 6-268 and 6-273), developed through a combined deterministic and stochastic approach. Each simulation uses a hypothesized hydrogeologic framework (deterministic model) to generate 1,000 realizations (runs) of groundwater travel times. For each run, certain system parameter values are chosen randomly from parameter distributions of test data or from assumed parameter ranges where no test data are available. The groundwater travel time distribution for porous media flow has a median value of 240,000 years and shows a 95.5 and 99.7 percent probability of travel times equaling or exceeding 10,000 and 1,000 year respectively. The fracture flow distribution has a median value of 120,000 years and shows a 78.6 and 92.6 percent probability of travel times equaling or exceeding 10,000 and 1,000 years.

In spite of the conclusions above, the NRC staff has significant concerns with the new analysis and how the analysis results are used in arriving at the conclusions for groundwater travel time. Because of limitations in the approach toward modeling groundwater travel times in the final EA, the frequency distributions for predicted groundwater travel times incorporate only some of the estimated uncertainties in those parameters input to the model as random variables. Uncertainties in those parameters treated as constants, uncertainty about the nature of the parameter distributions, uncertainty about the conceptual model, uncertainty about the boundary conditions and uncertainty about some of the assumptions used in the mathematical flow model are not accommodated in the uncertainty analysis. Given below is a brief description of specific problems with the new groundwater travel time methods of analysis and the use of the analysis results.

1. The fundamental limitation of the numerical model (PTRACK model (Andrews, et al., 1985 and Thompson, et al., 1985)) is that mass is not conserved when approximating conceptual hydrogeologic flow models. Models of steady state flow systems such as PTRACK should include a balance between inflow and outflow, or between sources of recharge and discharge to guarantee that in a given realization the mass balance condition is satisfied. Furthermore, in PTRACK hydrogeologic boundaries are not based on physical properties of the real system but are located at a prescribed distance from the edge of the repository to the accessible environment. Therefore, some combinations of hydrogeologic parameters are not realistic. Whether any groundwater travel time prediction from a realization in PTRACK happens to fall within the range of possible travel paths expected in a physically-based conceptual model cannot be determined, and effects associated with real or perceived boundary conditions cannot be simulated.

PTRACK is designed to evaluate the impact of parameter uncertainties rather than conceptual model uncertainties. However, it is not clear how parameter uncertainties can be separated from conceptual model uncertainties and it has not be demonstrated that the impact of data uncertainties can be evaluated without using a physically-based conceptual hydrogeologic flow model.

2. Uncertainty about the nature of most of the variable parameter input distributions are not accommodated in the uncertainty analysis. Because of insufficient data, parameter statistical moments and probability distributions for many of the hydrogeologic parameters are assumed based on expert judgment or engineering estimates of measurement accuracy. For example, the method of

analysis (PTRACK) requires mean values of pressure head and variance. However, the mean pressure head values are based on single measurements from one well (GD-1) rather than a statistic compiled from many measurements in more than one well. Likewise, the variance, which is based on estimates of measurement accuracy of a single measurement, has no statistical meaning. Studies on the sensitivity of the analysis to estimate parameter statistical properties (characteristics of the distribution) were not performed.

3. Uncertainty in the way anisotropy and fracture porosity are treated as constants is not accommodated in the analysis. Permeability in non-salt layers is assumed to be anisotropic with the anisotropy ratio fixed at 10 in all cases. Although this appears to be a reasonable value, and possibly conservative in most cases, it is more reasonable to allow the anisotropy ratio to be characterized with uncertainty. In vertical fracture zones it is possible that anisotropy may even be less than one. No justification is given for assuming that fractures can be modeled simply by decreasing matrix porosity 100 fold. This is important because fracture zones in brittle rocks, such as dolomites, may have porosities exceeding matrix porosity. To account for the effect of fractures on groundwater travel time, it may be more appropriate to adjust permeability.

4. The groundwater travel time analysis does not accommodate uncertainty related to the significant difference in scale between the hydrostratigraphic units (layers) represented in the model and the data, which are primarily from single-hole field tests or laboratory tests on small samples. In the analysis, the hydraulic response over the test zone of influence of a single well or sample is integrated over the much larger space of the model to represent the bulk response of an entire unit. This is particularly significant to analyzing groundwater flow in fractured rock when, as in PTRACK, it is modeled as equivalent porous media.

5. The groundwater travel time analysis presented in the final EA may be inconsistent with those portions of NRC regulations and DOE guidelines requiring travel times to be evaluated explicitly in terms of the "fastest path of likely radionuclide travel" (10 CFR Part 60.113(a)(2) and 60.112(b)(7)), and "any path of likely significant radionuclide travel" (10 CFR Part 960.4-2-1(d)) and "any path of likely radionuclide travel" (960.4-2-1(b)(1)). The regulations and guidelines suggest that uncertainty in groundwater travel time should be evaluated in terms of individual paths of likely groundwater flow. However, because of the uncertainty in the hydrologic properties in the vicinity of the site, the expected flow path as well as groundwater travel times to the accessible environment are presently uncertain. Due to this current level of uncertainty, PTRACK was developed to calculate travel times from the edge of the disturbed zone to the accessible environment along all possible particle trajectories within the constraints of the model (final EA, Section 6.5.2.3.5, page 6-261, paragraph 1). Although more particles enter the accessible environment through either salt cycle 5 or salt cycle 6 interbeds than through any other layer in the system, defining the likely flow path is not possible because in PTRACK all particle trajectories have an equal

probability of occurrence (1 in 1000) (Andrews, et al., 1985). Andrews and others (1985) recognize the difference between PTRACK and the regulations and guidelines when they state that, while PTRACK may not be equivalent in a strict sense, it does provide the statistical distributions required to quantify the work "likely." The NRC staff disagrees, in that a distribution of "likely" groundwater travel times for 1000 equally probable particle trajectories may be significantly different than the distribution of groundwater travel times along an individual likely pathway. However, because of uncertainty in current data, the staff considers use of the PTRACK analysis to be technically supportable at this time, although its future use, when site data exists, would be significantly inconsistent with NRC regulations and DOE guidelines as noted above.

6. The NRC staff is concerned with how the analysis results are used to make conclusions on groundwater travel time. The entire porous media and fracture flow travel time distributions are not used in the evaluations. Instead, only mean and median values (central values) are used. Some portion of the distributions based on a percentile criteria smaller than the mean or median would more properly reflect current uncertainty. In evaluating groundwater travel time, the distribution for fracture flow is not considered. This is not a conservative assumption given current data on fractures.

In addition, the final EA states (Section 6.3.1.1.2, page 6-100, paragraph 3) that "the extreme upper and lower portions of the travel time distribution are characteristic of travel times along unlikely paths of radionuclide travel, and therefore, inappropriate for evaluating this favorable condition (10,000 year groundwater travel time). The DOE considers this judgment to be consistent with the NRC staff position regarding the groundwater travel time requirement in 10 CFR Part 60 (Browning, 1985)."

For the eventual application of its regulation, the NRC is considering excluding the extremes of the distribution of possible groundwater travel times for the fastest path of radionuclide travel in determining whether the performance objective has been met. However, excluding the tails (extremes) of a distribution is not equivalent to choosing the mean or median as the measure of groundwater travel time. This is particularly so for initial screening prior to site characterization, where attempting to reach conclusions about "likely" and "unlikely" flow paths is speculation at best. Indeed, prematurely and arbitrarily eliminating the tails of the groundwater travel time distribution at this time virtually ignores the uncertainty that the current analyses were intended to incorporate. The meaning of the NRC statement referring to excluding extremes is simply that the NRC might consider the performance objective to be met even if some small portion of the distribution was less than the time criterion (e.g., 1000 years), assuming the concepual model and other determining factors behind the distribution itself are defensible.

Finally, it should be noted that since all particle trajectories are equally probable in the PTRACK model, extremely long or short travel times are the result of the probabilistic combination hydrogeologic parameters and are not related to the unlikeliness of individual radionuclide pathways.

Comment 4

Decomposition of Carnallite

Guideline on Geochemistry 10 CFR 960.4-2-2 (c) Potentially Adverse Condition (2)

In the NRC major comment 5 of the draft EA for Davis Canyon, the concern was raised that the amount of carnallite near the waste packages and the potential thermal alteration of the hydrated phases were not considered in determining rock strength and water content of the host rock. No new information or revised assumptions regarding the amount of hydrated phases or the water content present in the host rock is included in the final EA. Thus, the NRC considers that its original comment concerning the amount of carnallite is appropriate to the final EA. While discussions have been added to the final EA regarding the carnallite dehydration process, the possible effects of the process on rock strength have not been evaluated. The following paragraph further explains the NRC concerns.

The final EA cites the study of Conner (1983) in describing the thermal stability of carnallite. In that study carnallite was subjected to differential thermal analysis (DTA). It was found that carnallite ($KMgCl_3 \cdot 6H_2O$) begins to dehydrate between 85 and 90°C and loses four of its six molecules of water. The last two molecules of water, which may be more tightly bound in the crystalline structure, are lost starting at 150°C with complete dehydration at 185°C. For every mole of carnallite that decomposes, 6 moles of H_2O, one mole of KCl, and one mole of $MgCl_2$ are produced. The resulting solid products are KCl and $MgCl_2$, two phases with relatively high melting points. Although this study accurately describes the decomposition of carnallite when water does not remain in the carnallite bed, it does not adequately describe the situation when the water of carnallite decomposition remains in place. The statement is made in the final EA that water from carnallite decomposition is not expected to move from the carnallite beds (Section 3.2.6.1, page 3-95 and Section 3.2.7.1, page 3-101). The final EA does not consider that some quantity of the anhydrous components produced in the dehydration reaction will be dissolved in the water of dehydration at temperatures below the melting point of carnallite. Thus, the relative proportions of liquid to solid produced in this dehydration reaction are underestimated in the final EA. The minimum liquid/solid volume ratio is 0.58 assuming none of the anhydrous [illegible] produced in the dehydration reaction dissolves in the H_2O. Depending on the distribution of carnallite in the host rock relative to the waste packages, rock strength could be reduced. Thin laminae containing a large percentage of carnallite in the vicinity of the waste packages could result in planes of weakness. The final EA has not recognized or evaluated this effect and has concluded that rock strength will not be affected.

Comment 5

Redox Conditions - (Draft EA Major Comment 6)

Guidelines on Geochemistry 10 CFR 960.4-2-2(b)(2),(c)(3)

In the NRC staff major comment 6 of the draft EA for the Davis Canyon site, concerns were raised that the limitations in current evidence regarding processes that affect radionuclide migration, such as precipitation, sorption, radiocolloid formation, and organo-radionuclide complexation, were not factored into estimates of the above parameters which may lead to underestimations of radionuclide mobility. Examination of the final EA indicates that discussions of sorption, radiocolloid formation, and organo-radionuclide complexation have been adequately revised to include discussions of uncertainties in the data (Section 6.3.1.2.2, pages 6-125, items 3 through 6); however, concerns with redox conditions have not been factored into discussions and evaluations presented in the final EA regarding the mobility of redox-sensitive radionuclides (Section 6.3.1.2.2, pages 6-124 to 6-125, items 1 and 2; Section 6.3.1.2.3, page 6-133, last paragraph).

The NRC staff is concerned that evidence presented in the final EA does not support the conclusion that the groundwater is chemically reducing. The final EA states that the presence of reducing mineral assemblages, dissolved gases, and organics is qualitative evidence of chemically reducing conditions in both the Paradox Formation and in deeper groundwaters (Section 6.3.1.2.2, pages 6-124 to 6-125, items 1 and 2; Section 6.3.1.2.3, page 6-133, last paragraph). In addition, Eh values measured in deep basin brines are reported to be less than -80 mV (Section 6.3.1.2.3, page 6-134, continuing paragraph). The NRC staff is concerned that the presence of reducing mineral assemblages, dissolved gases, and organics, although indirect evidence of reducing conditions, is not conclusive because these components can exist metastably under oxidizing conditions. This possibility is not discussed in the final EA. Also, there is great difficulty in obtaining reliable Eh measurements, and these measurements may not represent actual conditions (e.g., see Lindberg and Runnells, 1984). Due to the uncertainties of the evidence presented, the existence of reducing or oxidizing conditions cannot be stated unequivocally in the absence of analyses which establish a consistency between various types of quantitative data.

Even assuming that reducing conditions are present, no evidence is presented in the final EA to show that redox-sensitive radionuclides released from the waste form will be reduced. If redox-sensitive actinide elements are dissolved from the waste form in the oxidized state, kinetic effects may prevent the establishment of redox equilibria and inhibit the transformation of oxidized actinide species to reduced species, which tend to be less mobile. This is of major concern regarding long-term release to the accessible environment because redox-sensitive radionuclides such as plutonium, uranium, neptunium and technetium have long half-lives. No evidence is presented to suggest how kinetic constraints will be overcome. Furthermore, contradictory statements regarding redox conditions are made. It is stated in the final EA that the oxidized species $UO_2(CO_3)_3^{4-}$ "can be thermodynamically stable under reducing conditions" (Section 6.3.1.2.2, page 6-125, item 5); elsewhere, however, it is stated that reducing conditions expected in the host salt and deep basin aquifers "will promote the precipitation of many redox sensitive radionuclides" (Section 6.3.1.2.2, page 6-124, paragraph 3) and "redox-sensitive radionuclides are expected to be stable in their lower oxidation states" (Section 6.3.1.2.2, page 6-125, paragraph 1). The NRC staff considers that the conclusion that redox-sensitive radionuclides will be in reduced states is premature because the field data on redox conditions are limited and highly uncertain and there is a lack of experimental studies investigating redox equilibria under chemical conditions expected in a repository.

Precipitation of radionuclides in the host salt and in the deep basin aquifers is an important process affecting radionuclide migration (Section 6.3.1.2.2, pages 6-124, paragraph 3, to 6-125, paragraph 1). Effective precipitation of redox-sensitive radionuclides is dependent on their being in a reduced state. The NRC staff believes that factoring uncertainties regarding redox conditions into the analysis can also support an alternative assumption that redox-sensitive radionuclides might remain in the more mobile oxidized state during the isolation time period.

Comment 6

Effects of Host Rock Mass Heterogeneity - (Draft EA Major Comment 7)

Guidelines on Rock Characteristics 10 CFR 960.4-2-3(b)(1), (b)(2), (c)(1), (c)(3), and 960.5-2-9(b)(1), (c)(2)

The Davis Canyon draft EA major comment 7 raised concerns that the existence of heterogeneities within the repository site and their possible effects on waste isolation were not adequately considered in the evaluations of rock characteristics related to the availability of a suitable host rock and the level of complexity of technology needed for the construction, operation and closure of the repository. Although the final EA recognizes that heterogeneities may exist within the Davis Canyon site (Section 3.2.6), the NRC staff continues to question whether the possible thermal and mechanical effects of heterogeneities have been conservatively factored into the evaluation of repository construction, operation, and maintenance.

The final EA states that "Paradox Salt is relatively pure" (Section 3.2.6.1, page 3-79) and "... the salt fabric in the repository host rock is expected to be relatively competent and homogeneous over the total area to be mined" (Section 6.3.1.3.2, page 6-137). Estimated values of physical, thermal, and geomechanical properties of the host rock reported in Tables 3-5 and 3-6 are determined from limited laboratory testing of core samples taken from the GD-1 borehole located approximately 5 miles from the site (Section 6.3.1.3.1, page 6-135). The evaluations presented in the final EA consider these estimates representative of the in-situ host rock mass. However, the effects of host rock heterogeneities on rock mass properties are unknown. Therefore, the representativeness of these estimates of in-situ rock mass properties is uncertain.

With respect to conclusions based on the thermal and ductility properties of the host rock, the uncertainties due to a lack of data associated with the effects of heterogeneities and impurities on fracture healing, and the response of carnallite/anhydrite to high temperatures were not considered in the analysis. Since uncertainties in the accuracy of the data have not been considered, the evaluation may not be conservative. Furthermore, the evaluations in the final EA do not reflect consideration of the effects of heterogeneities on strength, creep behavior, thermal conductivity, dehydration, and porosity of the host rock mass. These effects may limit design flexibility, roof and opening stability, and the requirements for rock support and reinforcement. Mining experience (such as at the Waste Isolation Pilot Plant (WIPP)) indicates that the effects of unforeseen heterogeneities should not be discounted since the engineering behavior of a salt rock mass can be dominated by heterogeneities, particularly when under the influence of waste-induced thermomechanical loadings. The NRC staff considers that substantial uncertainties remain that were not factored into the final EA evaluations of 1) rock mass physical, thermal, and engineering properties, 2) opening stability, 3) the extent of the disturbed zone, 4) rock support requirements, and 5) flexibility in locating the underground facility.

The evaluation which deals with the requirement for engineering measures that are beyond reasonably available technology for the construction of the shafts and underground facilities, does not reflect the requirement for special engineering measures that may result from rock mass heterogeneities when constructing adjacent to areas of emplaced waste. Opening stability may be adversely affected and may require complex rock support systems and reinforcement. The presence of heterogeneities may increase the extent of the disturbed zone beyond the 15 meters which has been estimated in Appendix 6A of the final EA (page 6A-7).

The evaluation which deals with rock conditions requiring engineering measures beyond reasonably available technology for construction, operation, and closure if such measures are necessary for waste containment and isolation does not include an analysis of (a) the engineering behavior of heterogeneous salt under anticipated repository environmental conditions, (b) the relationship of the cited excavation technology applied to ambient conditions to the excavation technology that will be required for the expected repository host rock thermomechanical behavior conditions, and (c) requirements for a retrieval system.

The evaluation of the existence of geologic structure, material properties, and hydrologic conditions such that heat generated by emplacement waste could reduce isolation does not show that the effects of heterogeneities on the thermal and mechanical properties of the host rock and on porosity increases, or on ground movements due to emplaced waste heat would necessarily be localized or negligible. The effects of these heterogeneities on characterizing evaporite response to thermal loading, the reaction of overlying stratigraphic units to waste heat, and the potential translation of stresses and strains to repository excavations outside the expected thermal pulse have not been addressed.

Finally, the evaluations which address host rock thickness and lateral extent to allow sufficient flexibility in selecting depth, configuration, and location of the underground facility do not reflect consideration of the effects of heterogeneities that may limit the available lateral extent of host rock needed for locating the underground facility. The lateral extent may be particularly limited due to both the potentially adverse stresses created by the mesas in the area if the two phase repository design is used, and to the proximity of the repository to Canyonlands National Park. Since the existence of heterogeneous features can affect creep and associated maintenance excavation requirements, it may be necessary to increase the size of the repository by reducing the design areal thermal loading. By doing so, the impact of heterogeneities on maintenance excavation requirements in a heated environment would be reduced. It may also be necessary to adjust the emplacement design due to the presence of heterogeneities into a larger repository area. Therefore, the NRC staff considers that the potential effects of heterogeneities in limiting the lateral flexibility of the repository location have not been considered.

Comment 7

Shaft Sealing - (Draft EA Major Comment 9)

Guidelines on Rock Characteristics 10 CFR 960.4-2-3(c)(1), (c)(3), and 10 CFR 960.5-2-9(c)(2)

The draft EA major comment 9 for Davis Canyon raised concerns that uncertainties and available evidence associated with constructing, sealing, and decommissioning shaft systems to assure containment and isolation of the waste were not adequately addressed. Review of the final EA indicates that, although the discussions on shaft construction were expanded (Section 4.1.2, pages 4-23 to 4-43), the information presented did not identify specific uncertainties described below related to the effectiveness of existing ground freezing and sealing technology and factor them into performance assessment of shaft seals.

The evaluation of in-situ characteristics and conditions which would require engineering measures beyond reasonably available technology in the construction of shafts does not address many of the sources of uncertainties associated with constructing shafts using reasonably available technology. The shaft construction concept presented in the final EA incorporates ground freezing technology to control rock movements and water flow. In the final EA (Section 6.3.3.2.3 (2), page 6-191), it is stated that "The freezing method, which if required at the Davis Canyon site, appears to have minimal impact on mechanical properties, although clay partings may deform when frozen." The discussion does not present an evaluation of the mechanisms which could cause permeability increases for the site soil and rock materials when subjected to freeze-thaw cycles. It is the opinion of the NRC staff that the heterogeneous physical nature of the ground to be frozen, the unavoidable deviations in freeze holes alignment, variations in the zone disturbed by shaft excavation, and liner placement all suggest that both freezing and thawing will be non-uniform. Non-uniform freezing and thawing would result in uncertain reliability of freezewall performance and variability in parameter values required for engineering. Increased permeability associated with shaft freezing and thawing could progressively reduce shaft integrity by introducing difficulties in achieving effective grouting and deleterious initial and long-term flow paths in penetrated strata. The final EA also proposes using grouting to control water flows in shafts (page 4-39, paragraph 3). It should be noted that in evaporite mines, it was reported that recurrent grouting to maintain seal performance is common and should be expected (ONWI-255, 1981, page 84). Furthermore, grouting processes are difficult to control, particularly in deviatoric in-situ stress fields where grouting can cause permeability to increase rather than decrease permeability (Houlsby, 1982, page 29). Therefore, based on the limited information available and the reasons given above, the NRC staff considers that over the pre-closure period there may be an increasing probability of progressive seal and liner deterioration that could lead to groundwater inflow and possibly shaft failure.

The evaluation of rock conditions that could require engineering measures beyond reasonably available technology for the closure of a repository if such measures are necessary to ensure waste isolation did not recognize or factor in the following sources of uncertainty. Changes to the shaft system, which can be expected to occur during the pre-closure period (i.e., seal deterioration, leakage damage, liner deterioration, etc.) due to the groundwater flow, might adversely affect the performance of the decommissioning seal system. Sealing materials, which are not yet designed or developed for long term compatibility with engineering and chemical properties of disturbed shaft wall rock and grout materials, may prove ineffective due to uncertainties in the effects of aging on shaft system components. The response of shaft seals/walls to potential dynamic earthquake motions and the likelihood for damage to seals during both pre- and post-closure periods is also at present not clearly understood. Furthermore, decommissioning sealing of the repository with crushed salt backfill and bulkheads may, in some shafts/drifts, not effectively prevent shaft water from reaching the waste storage area. This is because consolidation of the backfill due to creep of the salt rock may not be sufficient to reduce permeability to desired levels as this is dependent on both placing the backfill at the correct density, and predicting the creep/closure of the drift walls, roof, and floor. Therefore, limited flow through decommissioned passages may be possible.

The NRC staff also considers that Sections 5.1.1.3, 5.1.4.2.2, and 6.3.1.3.3 in the final EA do not adequately address sources of uncertainty such as potential thermally-induced ground movements that could result in deleterious strains in shaft linings and seals. Although surface uplifts predicted by thermoelastic analyses (Section 6.3.1.3.3, page 6-140) could be conservative, such analyses, when carried out for subsurface strata, may result in a non-conservative estimate of their thermomechanical response. For example, the potential for differential movement within the subsurface strata due to the effects of joint, fissures and discontinuities has not been evaluated. Such an analysis of the thermomechanical interaction of site stratigraphy, backfill, and shaft seal, including the nonlinear material behavior and properties of these system components, may well reveal deformation modes and differential movements which could affect shaft seal behavior. Furthermore, by omitting the effects of fractures, the analysis presented in Section 6.3.1.3.3, page 6-140 neither conservatively accounts for creation and dilation of fractures in shaft wall rock nor for distress of seals and linings. These omissions underestimate the potential for water migration through the shaft seal system. The NRC staff considers that an expected surface uplift above the shaft pillar centerline due to a 25 W/M^2 areal loading (as estimated in Wagner, et al., 1984, ONWI-512) may result in differential strains affecting post-closure shaft seal system performance. Differential displacement within the decommissioned shaft pillar region could result from small temperature changes due to the high coefficient of thermal expansion of salt.

Comment 8

Waste Package Performance Predictions - (Draft EA Comment 10)

Guidelines 10 CFR 960.4-2-2(b)(4), 960.4-2-2(c)(1) and 960.4-2-3(c)(1)

NRC staff concerns expressed in major comment 10 on the draft EA for the Davis Canyon site that the performance of the engineered barrier system was based on a number of inadequately supported assumptions and that the uncertainties associated with these assumptions have not been adequately addressed. The NRC staff recognizes that the response in the final EA indicates that some specific areas of uncertainty in the analysis such as temperature profiles, radiation effects, solubilities, brine quantities, corrosion modes and performance models that were discussed in the draft EA comment will be addressed during site characterization (Sections 6.4.2.3.3, page 6-247, third paragraph, and 6.4.2.7, page 6-287, last paragraph). However, examination of the final EA (Section 6.4.2, pages 6-213 to 6-287) indicates that the consequences of these assumptions and uncertainties on the analyses of waste package lifetime and radionuclide release rate have not been adequately addressed and, in large measure, the major comment on the draft EA continues to apply to the final EA.

The final EA recognizes that waste package design changes will be needed (Section 6.4.2.2.1, page 6-221) if the assumptions used in drawing conclusions regarding the post-closure guidelines (Sections 6.4.2.3.1, pages 6-235 to 6-250, and 6.4.2.3.4, pages 6-250 to 6-257) are not validated during site characterization activities (Appendix C, page C.5-47). However, the NRC staff continues to hold that the assumptions are not yet substantiated and the current range of uncertainties are not reflected in the conclusions. For example, the final EA continues to use the code BRINEMIG to model brine migration despite the fact that the code was developed using "assumptions... which do not realistically describe the movement of brine in salt" (Section C.5.11, page C.5-53). The model gave results for brine flow rates that were consistently less than observed results in in-situ heater experiments at the Waste Isolation Pilot Plant (WIPP) facility (Nowak, 1986). The use of BRINEMIG to conservatively predict brine migration rates is clearly questionable. In another example, the final EA continues to assume that brine entering a borehole will distribute itself uniformly over the overpack and that the overpack will corrode uniformly (Section 6.4.2.3.3, page 6-247). During the period the backfill remains as crushed salt, it is more likely that brine will collect at the bottom of each borehole and lead to corrosion over a limited portion of the overpack. As to the mode of corrosion, while uniform corrosion of overpack materials has been observed under some conditions (Kreiter, 1983; Westerman et al., 1983), the susceptibility of carbon steels to pitting corrosion, crevice corrosion, and stress-assisted cracking has been historically observed (Turnbull, 1983; Strutt et al., 1985; Ito et al., 1984; and Kruger, 1959) under other conditions. This observation raises significant questions regarding the long-term performance of the overpack. The final EA indicates that parametric studies have been performed (Section 6.4.2.3.3, page 6-247, paragraph 3) which use pitting ratios to account for the uncertainties in the uniform corrosion assumption. Neither the assumed pitting ratios nor the relationship between uniform and pitting or other localized corrosion process has yet been substantiated by data and analysis, but the final EA indicates (Section 6.4.2.3.3, page 6-247, paragraph 5) a high sensitivity of the computational results to non-uniform corrosion. Without adequate consideration of these alternative failure mechanisms, the NRC staff does not consider that the predicted 10,000 year container lifetime (which assumes uniform corrosion) reflects the current uncertainties.

Comment 9

Potential Field Studies in Canyonlands National Park (Draft EA Major Comment 12)

Guidelines on Environmental Quality 10 CFR 960.5-2-5(a), (c)(3), (d)(2) and (d)(3)

Examination of the final EA (Section 4.1.1.1, Geologic and Hydrologic Studies) indicates that the NRC staff concerns expressed in draft EA major comment 12 about the program of field investigations proposed in Chapter 4 of the draft EA and its apparent incompleteness with respect to the hydrologic and geologic features and conditions in and in close proximity to Canyonlands National Park, at Davis Canyon proposed repository have not been addressed.

For example, the final EA for the Davis Canyon site (Section 4.2.1.1.3, page 4-88, paragraph 8) states "Site characterization activities such as borehole drilling and trenching will not occur within the boundaries of the Canyonlands National Park." The NRC staff again considers that the lack of geologic and hydrologic studies in and close to the National Park, as proposed in the final EA, may result in an incomplete site characterization program insufficient to produce needed data critical to the understanding of the hydrology and the geology of the Davis Canyon site.

Based upon the above, the NRC staff considers that the technical concerns and associated bases in its draft EA comment (major comment 12) is appropriate to the final EA and has included it as an attachment (Attachment 1).

Attachment 1

Comment 12

Potential Field Studies in Canyonlands National Park

Guidelines on Environmental Quality 10 CFR 960.5-2-5(a), (c)(3), (d)(2), and (d)(3).

The program of field investigations proposed in Chapter 4 of the draft EA does not address many of the geologic and hydrologic features and conditions in and in close proximity to Canyonlands National Park which might be important to repository performance. Also, consideration has not been given to the possibility that a larger control area might be needed than is presented in the draft EA (see major comment 11). The apparent incompleteness of the field program outlined would result in an under-estimation of the environmental impacts the field program will have on Canyonlands National Park.

Tectonic features, such as the Imperial fault zone, and salt dissolution features, such as the Grabens and Needles fault zones are present in the park. The relationship of such features to subsurface stratigraphy, dissolutioning and ground water flow is presently not well understood. The draft EA does not present a program that would resolve the NRC's concerns regarding tectonic features and dissolution (see major comments 1 and 2).

The Shay Graben appears to be part of a tectonic system that also includes the Bridger Jack and Salt Creek grabens (see detailed comment 3-10). This system is a potential active fault zone, a potential source of earthquakes, and a potential area of dissolution. It does not appear that a sufficiently detailed field program has been planned to fully evaluate this complex structural zone. The need for more borings, seismic lines and trenches has not been considered in the draft EA. This system lies within and in close proximity to Canyonlands National Park.

The DOE has identified several geophysical anomalies which do not appear to have been sufficiently analyzed (see major comments 1 and 2). Until these anomalies are understood with respect to structure and dissolution, it is impossible to predict the effect they will have on waste isolation. These features appear to overlap the eastern boundary of the park; therefore, investigations of these anomalies may have an effect on the park. The proposed field program in the draft EA does not include evaluations of these features.

The hydrologic testing scheme proposed for site characterization in chapter 4 does not describe any data collection between approximately 2 km and 22 km down gradient from the edge of the Geologic Repository Operations Area. The draft EA includes no technical justification for limiting intensive characterization to within 2 km of this area. The testing scheme may appear to be defensible on the basis of the hydrogeologic setting description presented in the draft EA which indicates that all radionuclide transport requirements can be met within an area of limited horizontal extent. However, the NRC concludes that this testing scheme may not be consistent with the present level of uncertainty regarding the possibility of certain hydrogeologic conditions such as localized upward gradients, flow thru interbeds and vertical structurally controlled flow (see detailed comment 4-2).

If a larger controlled area is needed (see major comment 11) which might overlay the park boundary, then evaluations are needed in the final EA to determine if additional site characterization activities are needed in this area.

The field program proposed in the draft EA does not appear sufficient in scope to resolve many of the potential technical concerns. The NRC, therefore, considers the above concern has not been adequately factored into the analysis in support of the Environmental Quality Guidelines 960.5-2-5(a), 960.5-2-5(c)(3), 960.5-2-5(d)(2) and 960.5-2-5(d)(3).

In revising the draft EA, the DOE should consider re-evaluating the field investigation program to determine if it will provide the information necessary to address the concerns raised above. The DOE should also consider revising those portions of the draft EA dealing with effects on Canyonlands National Park to reflect any revisions to the field program.

REFERENCES

Andrews, R.W., Kelley, V.A., McNeish, J.A., LaVenue, A.M., and Campbell, J.E., 1985. Travel Path/Time Uncertainties at Salt Sites Proposed for High Level Waste Repositories: Prepared by Intera Technologies, Inc. for Office of Nuclear Waste Isolation, ONWI/E512-02900/TR-36.

Browning, R.E., 1985. Letter to R. Stein (DOE), June 12, 1985, regarding NRC position on groundwater travel time.

Conner, Trent Gregory, 1983, "The Mineralogy and Water Content of Paradox Basin Evaporite Deposits," M.S. thesis, Georgia Institute of Technology, Atlanta, GA.

D'Appolonia Consulting Engineers, 1981. "Sealing Considerations for Repository Shafts in Bedded and Dome Salt," ONWI-255, Office of Nuclear Waste Isolation, Battelle Memorial Institute, Columbus, OH, p. 84.

Houlsby, A.C. "Cement Grouting for Dams," in ASCE "Proceedings of the Conference on Grouting in Geotechnical Engineering," 1982, New Orleans, LA, p. 29.

Ito, S., T. Murata and H. Okada, 1984. "A Statistical Approach to Corrosion of Marine Steel Structures," International Congress on Metallic Corrosion, Toronto, June 3-7.

Kreiter, M.R., 1983, "Waste Package Program," Section 3.1.1 in J.L. McElroy and J.A. Powell, compilers, Nuclear Waste Management Semiannual Progress Report, April 1983 through September 1983, PNL-4250-4, prepared for U.S. Department of Energy by Pacific Northwest Laboratory, Battelle Memorial Institute, Richland, WA, pp. 3.1-3.29.

Kruger, J., 1959. "Influence of Crystallographic Orientation on the Pitting of Iron in Distilled Water," Journal of the Electrochemical Society, Vol. 106, No. 8, p. 736.

Lindberg, R.D., and D.D. Runnells, 1984, "Ground Water Redox Reactions: An Analysis of Equilibrium State Applied to Eh Measurements and Geochemical Modeling," Science, v. 225, p. 925-927.

Nowak, E.J., 1986. Preliminary Results of Brine Migration Studies in the Waste Isolation Pilot Plant (WIPP), Sandia National Laboratories Report SAND86-0720, Albuquerque, NM.

State of Utah High Level Nuclear Waste Office, 1986, Davis Canyon Data Review and Comments.

Strutt, J.E., J.R. Nicholls and B. Barbier, 1985. "The Prediction of Corrosion by Statistical Analysis of Corrosion Profiles," Corrosion Science, Vol. 25, No. 5, pp. 305-315.

Thompson, B.M., Campbell, J.E., and Lognsine, D.E., 1985. PTRACK; A Particle Tracking Program for Evaluating Travel Path/Time Uncertainties: Prepared by Intera Technologies, Inc. for Office of Nuclear Waste Isolation, ONWI/E512-02900/CD-27.

Turnbull, A., 1983. "The Solution Composition and Electrode Potential in Pits, Crevices and Cracks," Corrosion Science, Vol. 23, No. 8, pp. 833-870.

U.S. Department of Energy, 1984. "Nuclear Waste Policy Act of 1982; General Guidelines for the Recommendation of Sites for the Nuclear Waste Repositories; Final Siting Guidelines," (10 CFR Part 960), Federal Register, Vol. 49, pp. 47714-47770, Washington, DC, December 6.

U.S. Department of Energy, 1984. Draft Environmental Assessment, Davis Canyon Site, Utah, Office of Civilian Radioactive Waste Management, Washington, DC.

U.S. Department of Energy, 1986. Final Environmental Assessment, Davis Canyon Site, Utah, Office of Civilian Radioactive Waste Management, Washington, DC.

U.S. Nuclear Regulatory Commission, 1985. NRC Staff Comments on the DEA for Davis Canyon Site, Utah, Office of Nuclear Material Safety and Safeguards, Washington, DC.

U.S. Nuclear Regulatory Commission, 1986. "Disposal of High-Level Radioactive Wastes in Geologic Repositories," 10 CFR Part 60, Subpart E, Technical Criteria. Code of Federal Regulations - Energy. Office of the Federal Register, Washington, DC.

U.S. Nuclear Regulatory Commission, 1986. "Draft Generic Technical Position on Groundwater Travel Time (GWTT)," Office of Nuclear Material Safety and Safeguards, Washington, DC, July 1986.

Wagner, R.A., M.C. Loken and H.Y. Tammemagi, 1984. "Preliminary Thermomechanical Analyses of a Conceptual Nuclear Waste Repository at Four Salt Sites," ONWI-512, Office of Nuclear Waste Isolation, Battelle Memorial Institute, Columbus, OH, 228 p.

Westerman, R.E., J.L. Nelson, S.G. Pitman, W.L. Kuhn, S.J. Basham and D.P. Novak, 1983. Evaluation of Iron Base Materials for Waste Package Containers in a Salt Repository, PNL-SA-11713, Paper D5.10, by Pacific Northwest Laboratory and Nuclear Waste Isolation, Battelle Memorial Institute, presented at Materials Research Society Annual Meeting, Boston, MA, November 14-17.

MAJOR COMMENTS
ON
DEAF SMITH SITE

Comment 1

Dissolution (Draft EA Major Comments 1 and 2)
Guidelines on Dissolution 10 CFR 960.4-2-6(a), (b), and
Geochemistry 10 CFR 960.4-2-2 (b)(1)

In the NRC staff major comments on the draft EA for Deaf Smith, the following concerns were raised with respect to dissolution:

1) uncertainty of projected rates of peripheral dissolution;
2) evidence of present and Pleistocene dissolution in the geologic setting;
3) effect of structural control on the dissolution process; and
4) possibility that thinning of host rock in vicinity of site may be related to deep interior dissolution.

Examination of the final EA indicates that the above four concerns have been addressed to varying degrees in the final EA as discussed below.

The analysis of the uncertainty of projected rates of peripheral dissolution (item 1) in the final EA appears to have responded to NRC concerns by reflecting the wide range of rates estimated from stream solute analyses along the northern and eastern dissolution fronts (Sections 3.2.3.3.1 and 6.3.1.6.1) and acknowledges that future pluvial conditions may increase dissolution at salt margins (Section 6.3.1.4). However, the analysis in the final EA (qualifying condition 10 CFR 960.4-2-6(a), pages 6-124 and 6-125) continues to treat the Permian salts as an isotropic, homogeneous medium in which dissolution rates are relatively uniform. This assumption does not consider the possibility that structural discontinuities such as through-going joints, fractures or faults may enhance dissolution along structural trends resulting in local dissolution front(s) closer to the site.

In response to item 2 of the NRC concerns, evidence of Pleistocene dissolution within the Southern High Plains is discussed in Sections 3.2.3.3.2 and 6.3.1.6.2 of the final EA. In Section 3.2.3.3.2, Interior Dissolution, the final EA states "the Southern High Plains lack most of the easily identified surface expressions of on-going or recent dissolution, such as collapse sinkholes, closed depressions, linear drainage elements and fractures (Gustavson et al., 1981; Gustavson and Finley, 1984)." Notably missing from this statement is any reference to the concern over playas raised in the NRC comment on the draft EA. There is no mention of playas which are present at the site as shown in Figure 4-2 or the possibility that they may be related to dissolution. However, in another section of the final EA (Section 3.2.3.3, page 3-48, paragraph 4) it is stated that some playas in the Palo Duro Basin may be related to dissolution. This omission results in an incomplete recognition and evaluation of features that might be evidence for Pleistocene dissolution at or near the site.

A second point to raise with respect to item 2, evidence of present or Pleistocene dissolution within the geologic setting, is that in the final EA (Section 6.3.1.6.2, page 6-125) it is stated that "no evidence has been found for Quaternary dissolution of the host rock at or near the site." Yet there is evidence of Pleistocene dissolution within the Southern High Plains. This evidence consists of lake basins containing Pleistocene sediments which occur "over areas of thin salt, structural lows on the Alibates Formation, and paleotopographic lows in the middle Tertiary erosional surface" which are interpreted to have formed as a result of dissolution during the Late Pliocene/Early Pleistocene (Gustavson and Finley, 1984, page 16). As noted in the NRC comments on the draft EA, deformation of the Pleistocene Tule Formation lacustrine sediments in northeast Swisher County, if caused by dissolution as Gustavson and Budnik (1984) suggest, provides the strongest evidence to-date for Pleistocene or younger dissolution in the Southern High Plains. None of this evidence was identified or evaluated in the final EA with respect to Quaternary dissolution near the site.

The final point to be made with respect to item 2 is that the discussion in the final EA of regional stratigraphy (Section 3.2.3.1) and site stratigraphy (Section 3.2.3.2) does not reflect new information which could affect the evaluation of Pleistocene dissolution. Table 3.3 of the final EA indicates that the Tertiary Ogallala Formation is present at the surface at the site. This is inconsistent with the representation of surface geology in Figure 3-18 which indicates that Quaternary loess and playa deposits are the surficial deposits at the site. Furthermore, according to Gustavson and Holliday (1985), the Quaternary Blackwater Draw Formation is present at the Deaf Smith site. This formation is known to be 10m thick at the type locality in northern Lubbock Co. and ranges in thickness to at least 25m locally. As stated in the NRC observations during the August 5-9, 1985 NRC/DOE Permian Core examination meeting (NRC and DOE, 1985), "The extent and characteristics of (the Blackwater Draw Formation) are important to the resolution of issues such as Quaternary dissolution and warping and ages of latest movements on faults."

The NRC staff concern regarding structural control on the dissolution process (item 3) was addressed in Section 3.2.3.3.2 of the final EA where it was stated that Gustavson and Budnik's (1985) "interpretation of (relatively open) northeast basement faults is possible because of the sparseness and limitations of the data." It appears that in the final EA this interpretation is rejected by presenting evidence to the contrary and by concluding that "the northeast trend may not be stratigraphically pervasive." This means that salt units would not be intersected by permeable features along which groundwater could flow and dissolve salt locally. However, there is no evidence in the discussion that this interpretation has considered the following items which lend support to the Gustavson and Budnik interpretation of the possibility of structurally controlled dissolution:

1) northeast-trending basement fault alongside the Arney Block in southeast Deaf Smith county (Budnik, 1984, Figure 12; Johns, 1985,

Figure 40) which is not apparent in Figure 3 of Regan and Murphy (1984);

2) thinning (approximately 30 meters) of Seven Rivers Formation salt and total loss of Salado salt (approximately 30 meters) above northeast-trending basement structural elements in southeast Deaf Smith County (Gustavson and Budnik, 1985);
3) northeast-trending system of paleotopographic lows and series of closed basins within the mid-Tertiary erosional surface in eastern Deaf Smith county (Gustavson and Budnik, 1984); and
4) northeast-trending lineaments (based on Landsat imagery) parallel to Frio Draw, Tierra Blanca Creek, and the western segment of Palo Duro Creek (Finley and Gustavson, 1981).

In the NRC staff comments on the draft EA, coincidence of structural discontinuities (e.g., joints, fractures, northwest-trending faults and lineaments) and northwest-trending differential thinning of the San Andres Unit-4 in northern Deaf Smith county was cited as possible evidence of deep interior dissolution (item 4). The discussion in the final EA cites data published subsequent to the draft EA comments which indicate that the thinning of the San Andres Unit-4 in northeast Deaf Smith county resulted not from structurally controlled dissolution but from the transgression which initiated the deposition of Unit 5 (Hovorka et al., 1985). While the NRC staff considers this as one plausible interpretation, the sparsity of the data within the site as compared with the conclusion stated above indicates uncertainty in knowledge of the dissolution process. As stated in the NRC staff comments on the draft EA, there is no direct evidence of dissolution of the San Andres Unit-4, yet as Gustavson and Budnik (1985, page 176) state "there is a persistent pattern of structural and geomorphic features that can be best explained by dissolution of Seven Rivers and Salado salts during the late Tertiary and perhaps as late as the Quaternary." Given the current limitations in data and understanding of the dissolution process, the NRC staff considers that neither of the above interpretations for the differential thinning of the San Andres Unit 4 in northern Deaf Smith County can be ruled out at this time.

(The NRC staff considers the concerns expressed in major comment 1 (Structural Discontinuities) of the review of the draft EA for Deaf Smith are closely related to structural control on dissolution. For this reason, these concerns have been factored into the above discussion.)

Comment 2

Groundwater Travel Time - (Draft EA Major Comment 3)

Guideline on Geohydrology 10 CFR Part 960.4-2-1(b)(1)

The NRC staff major comment on the draft EA for the Deaf Smith site stated a general concern that many of the assumptions and approaches used in the groundwater travel time analysis were not conservative and did not incorporate appropriate uncertainties. In support of the major comment, the NRC staff cited several detailed comments describing specific concerns with respect to flow path, vertical hydraulic gradient, permeability, and porosity as follows. The draft EA used mean values for hydrogeologic parameters (permeability and porosity) for estimating travel times. Mean values as used in the draft EA analysis did not reflect spatial variation or heterogeneity relative to the distribution of hydrogeologic data within hydrostratigraphic units. The draft EA considered a single conceptual groundwater flow model and did not factor into the analysis the possibility of flow through permeable interbeds, or flow through fractures or along structural discontinuities. The vertical hydraulic gradient across hydrostratigraphic unit B was underestimated because underlying Wolfcamp potentiometric head data were not converted to environmental heads.

Examination of the Deaf Smith final EA indicates that the analysis for groundwater travel time has been revised significantly in attempting to incorporate uncertainties identified in the NRC staff major comment on the draft EA. A substantial degree of uncertainty and conservative assumptions are incorporated quantitatively into the new groundwater travel time calculations. Ranges of values for some hydrogeologic parameters are considered, as well as groundwater flow through permeable interbeds or along fracture zones. Environmental heads also are used to calculate vertical hydraulic gradients. In portraying uncertainty related to present knowledge of the Deaf Smith site groundwater flow system, the final EA presents simulated groundwater travel time distributions for both porous media and fracture flow (Section 6.4.2.3.5, pages 6-252 and 6-236), developed through a combined deterministic and stochastic approach. Each simulation uses a hypothesized hydrogeologic framework (deterministic model) to generate 1,000 realizations (runs) of groundwater travel times. For each run, certain system parameter values are chosen randomly from parameter distributions of test data or from assumed parameter ranges where no test data are available. The groundwater travel time distribution for porous media flow has a median value of 87,000 years and shows a 89.3 and 99.5 percent probability of travel times equaling or exceeding 10,000 and 1,000 year respectively. The fracture flow distribution has a median value of 25,000 years and shows a 61.9 and 81.4 percent probability of travel times equaling or exceeding 10,000 and 1,000 years.

In spite of the conclusions above, the NRC staff has significant concerns with the new analysis and how the analysis results are used in arriving at the conclusions for groundwater travel time. Because of limitations in the approach toward modeling groundwater travel times in the final EA, the frequency distributions for predicted groundwater travel times incorporate only some of the estimated uncertainties in those parameters input to the model as random variables. Uncertainties in those parameters treated as constants, uncertainty about the nature of the parameter distributions, uncertainty about the conceptual model, uncertainty about the boundary conditions and uncertainty about some of the assumptions used in the mathematical flow model are not accommodated in the uncertainty analysis. Given below is a brief description of specific problems with the new groundwater travel time methods of analysis and the use of the analysis results.

1. The fundamental limitation of the numerical model (PTRACK model (Andrews, et al., 1985 and Thompson, et al., 1985)) is that mass is not conserved when approximating conceptual hydrogeologic flow models. Models of steady state flow systems such as PTRACK should include a balance between inflow and outflow, or between sources of recharge and discharge to guarantee that in a given realization the mass balance condition is satisfied. Furthermore, in PTRACK hydrogeologic boundaries are not based on physical properties of the real system but are located at a prescribed distance from the edge of the repository to the accessible environment. Therefore, some combinations of hydrogeologic parameters are not realistic. Whether any groundwater travel time prediction from a realization in PTRACK happens to fall within the range of possible travel paths expected in a physically-based conceptual model cannot be determined, and effects associated with real or perceived boundary conditions cannot be simulated.

PTRACK is designed to evaluate the impact of parameter uncertainties rather than conceptual model uncertainties. However, it is not clear how parameter uncertainties can be separated from conceptual model uncertainties and it has not be demonstrated that the impact of data uncertainties can be evaluated without using a physically-based conceptual hydrogeologic flow model.

2. Uncertainty about the nature of most of the variable parameter input distributions are not accommodated in the uncertainty analysis. Because of insufficient data, parameter statistical moments and probability distributions for many of the hydrogeologic parameters are assumed based on expert judgment or engineering estimates of measurement accuracy. For example, the method of analysis (PTRACK) requires mean values of pressure head and variance. However, the mean pressure head values are based on single measurements from one well (J. Friemel No. 1) rather than a statistic compiled from many measurements in more than one well. Likewise, the variance, which is based on estimates of measurement accuracy of a single measurement, has no statistical meaning. Studies on the sensitivity of the analysis to estimate parameter statistical properties (characteristics of the distribution) were not performed.

3. Uncertainty in the way anisotropy and fracture porosity are treated as constants is not accommodated in the analysis. Permeability in non-salt layers is assumed to be anisotropic with the anisotropy ratio fixed at 10 in all cases. Although this appears to be a reasonable value, and possibly conservative in most cases, it is more reasonable to allow the anisotropy ratio to be characterized with uncertainty. In vertical fracture zones it is possible that anisotropy may even be less than one. No justification is given for assuming that fractures can be modeled simply by decreasing matrix porosity 100 fold. This is important because fracture zones in brittle rocks, such as dolomites, may have porosities exceeding matrix porosity. To account for the effect of fractures on groundwater travel time, it may be more appropriate to adjust permeability.

4. The groundwater travel time analysis does not accommodate uncertainty related to the significant difference in scale between the hydrostratigraphic

its (layers) represented in the model and the data, which are primarily from ngle-hole field tests or laboratory tests on small samples. In the analysis, e hydraulic response over the test zone of influence of a single well or mple is integrated over the much larger space of the model to represent the lk response of an entire unit. This is particularly significant to analyzing oundwater flow in fractured rock when, as in PTRACK, it is modeled as uivalent porous media.

The groundwater travel time analysis presented in the final EA may be nconsistent with those portions of NRC regulations and DOE guidelines equiring travel times to be evaluated explicitly in terms of the "fastest path f likely radionuclide travel" (10 CFR Part 60.113(a)(2) and 60.112(b)(7)), and any path of likely significant radionuclide travel" (10 CFR Part 960.4-2-1(d) nd "any path of likely radionuclide travel" (960.4-2-1(b)(1)). The egulations and guidelines suggest that uncertainty in groundwater travel time hould be evaluated in terms of individual paths of likely groundwater flow. owever, because of the uncertainty in the hydrologic properties in the icinity of the site, the expected flow path as well as groundwater travel imes to the accessible environment are presently uncertain. Due to this urrent level of uncertainty, PTRACK was developed to calculate travel times rom the edge of the disturbed zone to the accessible environment along all ossible particle trajectories within the constraints of the model (final EA, ection 6.5.2.3.5, page 6-247, paragraph 3). Although more particles enter the ccessible environment through the LSA Unit 4 interbed than through any other ayer in the system, defining the likely flow path is not possible because in TRACK all particle trajectories have an equal probability of occurrence (1 in 000) (Andrews, et al., 1985). Andrews and others (1985) recognize the ifference between PTRACK and the regulations and guidelines when they state hat, while PTRACK may not be equivalent in a strict sense, it does provide the tatistical distributions required to quantify the word "likely." The NRC staff disagrees, in that a distribution of "likely" groundwater travel times for 1000 equally probable particle trajectories may be significantly different than the distribution of groundwater travel times along an individual likely pathway. However, because of uncertainty in current data, the staff considers use of the PTRACK analysis to be technically supportable at this time, although its future use, when site data exists, would be significantly inconsistent with NRC regulations and DOE guidelines as noted above.

6. The NRC staff is concerned with how the analysis results are used to make conclusions on groundwater travel time. The entire porous media and fracture flow travel time distributions are not used in the evaluations. Instead, only mean and median values (central values) are used. Some portion of the distributions based on a percentile criteria smaller than the mean or median would more properly reflect current uncertainty. In evaluating groundwater travel time, the distribution for fracture flow is not considered. This is not a conservative assumption given current data on fractures.

In addition, the final EA states (Section 6.3.1.1.2, page 6-93, paragraph 3) that "the extreme upper and lower portions of the travel time distribution are characteristic of travel times along unlikely paths of radionuclide travel, and therefore, inappropriate for evaluating this favorable condition (10,000 year groundwater travel time). The DOE considers this judgment to be consistent with the NRC staff position regarding the groundwater travel time requirement in 10 CFR Part 60 (Browning, 1985)."

For the eventual application of its regulation, the NRC is considering excluding the extremes of the distribution of possible groundwater travel times for the fastest path of likely radionuclide travel in determining whether the performance objective has been met. However, excluding the tails (extremes) of a distribution is not equivalent to choosing the mean or median as the measure of groundwater travel time. This is particularly so for initial screening prior to site characterization, where attempting to reach conclusions about "likely" and "unlikely" flow paths is speculation at best. Indeed, prematurely and arbitrarily eliminating the tails of the groundwater travel time distribution at this time virtually ignores the uncertainty that the current analyses were intended to incorporate. The meaning of the NRC statement referring to excluding extremes is simply that the NRC might consider the performance objective to be met even if some small portion of the distribution was less than the time criterion (e.g., 1000 years), assuming the conceptual model and other determining factors behind the distribution itself are defensible.

Finally, it should be noted that since all particle trajectories are equally probable in the PTRACK model, extremely long or short travel times are the result of the probabilistic combination of hydrogeologic parameters and are not related to the unlikeliness of individual radionuclide pathways.

Comment 3

Redox Conditions - (Draft EA Major Comment 5)

Guidelines on Geochemistry 10 CFR 960.4-2-2(b)(2),(c)(3)

In the NRC staff major comment 5 of the draft EA for Deaf Smith Site, concerns were raised that the limitations in current evidence regarding processes that affect radionuclide migration, such as precipitation, sorption, radiocolloid formation, and organo-radionuclide complexation, were not factored into estimates of the above parameters which may lead to underestimations of radionuclide mobility. Examination of the final EA indicates that discussions of sorption, radiocolloid formation, and organo-radionuclide complexation have been adequately revised to include discussions of uncertainties in the data (Section 6.3.1.2.2, pages 6-100 to 6-102, items 3 through 6); however, concerns with redox conditions have not been factored into discussions and evaluations presented in the final EA regarding the mobility of redox-sensitive radionuclides (Section 6.3.1.2.2, pages 6-100 to 6-101, items 1 and 2; Section 6.3.1.2.3, page 6-105, paragraph 4).

The NRC staff is concerned that evidence presented in the final EA does not support the conclusion that the groundwater is chemically reducing. The final EA states that the presence of reducing mineral assemblages, dissolved gases, and organics is qualitative evidence of chemically reducing conditions in both the San Andres Unit and in deeper groundwaters (Section 6.3.1.2.2, pages 6-100 to 6-101, items 1 and 2; Section 6.3.1.2.3, page 6-105, paragraph 4). The NRC staff is concerned that the presence of reducing mineral assemblages, dissolved gases, and organics, although indirect evidence of reducing conditions, is not conclusive because these components can exist metastably under oxidizing conditions. This possibility is not discussed in the final EA. Due to the uncertainties of the evidence presented, the existence of reducing or oxidizing conditions cannot be stated unequivocally in the absence of analyses which establish a consistency between various types of quantitative data.

Even assuming that reducing conditions are present, no evidence is presented in the final EA to show that redox-sensitive radionuclides released from the waste form will be reduced. If redox-sensitive actinide elements are dissolved from the waste form in the oxidized state, kinetic effects may prevent the establishment of redox equilibria and inhibit the transformation of oxidized actinide species to reduced species, which tend to be less mobile. This is of major concern regarding long-term release to the accessible environment because redox-sensitive radionuclides such as plutonium, uranium, neptunium, and technetium have long half-lives. No evidence is presented to suggest how kinetic constraints will be overcome. Furthermore, contradictory statements regarding redox conditions are made. It is stated in the final EA that the oxidized species $UO_2(CO_3)_3^{4-}$ "can be thermodynamically stable under reducing conditions" (Section 6.3.1.2.2, page 6-101, item 5); elsewhere, however, it is stated that reducing conditions expected in the host salt and deep basin aquifers "will promote the precipitation of many redox sensitive radionuclides" (Section 6.3.1.2.2, page 6-100, item 1) and "redox-sensitive radionuclides are expected to be present in their lower oxidation states" (Section 6.3.1.2.2, page 6-101, item 2). The NRC staff considers that the conclusion that redox-sensitive radionuclides will be in reduced states is premature because the field data on redox conditions are limited and highly uncertain and there is a lack of experimental studies investigating redox equilibria under chemical conditions expected in a repository.

Precipitation of radionuclides in the host salt and in the deep basin aquifers is an important process affecting radionuclide migration (Section 6.3.1.2.2, pages 6-100 to 6-101, items 1 and 2). Effective precipitation of redox-sensitive radionuclides is dependent on their being in a reduced state. The NRC staff believes that factoring uncertainties regarding redox conditions into the analysis can also support an alternative assumption that redox-sensitive radionuclides might remain in the more mobile oxidized state during the isolation time period.

Comment 4

Effects of Host Rock Mass Heterogeneity - (Draft EA Major Comment 6)

Guidelines on Rock Characteristics 10 CFR 960.4-2-3(b)(1), (b)(2), (c)(1), (c)(3) and 10 CFR 960.5-2-9(b)(1), (c)(2)

In the Deaf Smith draft EA major comment 6, concerns were raised that the existence of heterogeneities within the site and their possible effects were not adequately considered in the evaluation of rock characteristics related to availability of suitable host rock and the level of complexity of technology needed for construction, operation, and closure of the repository. Review of the final EA indicates that the likelihood of heterogeneities within the host rock (Unit 4 of the lower San Andres formation) occurring as discrete mudstone or anhydrite interbeds or as irregular masses of chaotic mudstone/salt mixtures or anhydrite within the halite has been acknowledged (Section 3.2.3.2, page 3-40, paragraphs 1 to 6; Section 3.2.6, page 3-83, last paragraph; and Section 3.2.6.1, page 3-100, last full paragraph). Review also indicates that evaluations have been expanded to recognize the uncertainties regarding the site-specific host rock stratigraphy and the potential effect of discontinuities on the construction and operation of the repository at higher than ambient temperature. However, the NRC staff continues to question whether the possible thermal and mechanical effects of heterogeneities have been conservatively factored into the evaluation of repository construction, operation and maintenance.

With respect to conclusions based on the thermal and ductility properties of the host rock mass, the final EA presents estimates of physical, mechanical, and thermal properties of the salt at the Deaf Smith site as representing the host rock mass characteristics (Section 3.2.6, page 3-83). These estimates are drawn from limited laboratory testing of small samples of intact salt rock cores taken from four boreholes located several miles away (distance range from 4 to 22 miles) and therefore these cores may not adequately represent the clastic interbeds and chaotic mudstone/salt mixture heterogeneities that may be present at the site. As indicated in the final EA (Section 3.2.6, page 3-84) the effects of the existing interbeds on rock mass properties are unknown and their presence introduces uncertainties into any estimate of in-situ rock mass properties. The engineering behavior of the in-situ rock mass, especially under waste-induced thermo-mechanical loading, can be dominated by heterogeneities. Because of the present lack of site specific data related to the potential location and characteristics of heterogeneities at the Deaf Smith site and the resulting uncertainties associated with the analyses performed to evaluate the impact of those heterogeneities on the performance of the geologic repository, the NRC staff consider that substantial uncertainties remain that were not factored into the final EA evaluations of (1) rock mass physical, thermal, and engineering properties, (2) opening stability, (3) the extent of the disturbed zone, (4) rock support requirements, and (5) flexibility in locating the underground facility.

The evaluation of in-situ characteristics or conditions that could require engineering measures beyond reasonably available technology in the construction of the shafts and underground facilities, does not reflect requisite consideration of the special demands that probable rock mass heterogeneities may make on the requirement for engineering measures when constructing adjacent to areas of emplaced waste. Opening stability may be adversely affected and may necessitate increased requirements for complex rock support and reinforcement. The potential adverse effects of heterogeneities might also extend the disturbed zone beyond the 15 meters estimated in Appendix 6A of the final EA (page 6A-6).

The evaluation of conditions requiring engineering measures beyond reasonably available technology for construction, operation, and closure if such measures are necessary for waste containment and isolation presented on pages 6-111 and 6-112 does not include an analysis of the influence of heterogeneities on the requirements for engineering measures beyond reasonably available technology. Areas of particular concern include: (a) the lack of an analysis of the engineering behavior of heterogeneous salt under anticipated repository environmental conditions; (b) the lack of an analysis of the relevance of the cited extensive excavation technology experience under ambient conditions, to the full range of repository host rock thermomechanical behavior conditions to be expected at the Deaf Smith site; and (c) lack of analysis of requirements for a retrieval system.

The evaluation of the existence of geologic structure, material properties, and hydrologic conditions such that heat generated by emplaced waste could reduce isolation does not show that the effects of heterogeneities on the thermal and mechanical properties of the host rock, and on porosity increases, or on ground movements due to emplaced waste heat would necessarily be localized or negligible. The effects of heterogeneities on characterization of the salt rock response to thermal loading, the potential for non-uniform reaction of the overlying rock units to thermal loading, and the potential for differential transfer of stresses and strains both within and outside the thermal pulse have all not been addressed. If experienced, these effects might decrease the isolation provided by the host rock as compared with pre-waste-emplacement conditions.

Finally, the evaluations of host rock thickness and lateral extent to allow sufficient flexibility in selecting depth, configuration, and location of the underground facility do not reflect consideration of the occurrence of such heterogeneous features as irregular masses of chaotic mudstone/salt mixtures and large discrete mudstone beds (as identified in Section 3, page 3-40, fourth paragraph) and of the potential existence of pockets of gases or brine (as postulated in Section 6, page 161, third paragraph). The existence of heterogeneous features such as those described above can affect creep and therefore affect maintenance excavation requirements. Therefore, it may be necessary to reduce the design areal thermal loading to reduce the impact of heterogeneities on maintenance excavation requirements in a heated environment. This in turn increases the size of the underground facility. It may also be necessary to adjust the waste package emplacement configuration due to the presence of heterogeneities, which may also increase the size of the underground facility. The final EA recognizes that the amount of remedial excavation that is required during repository operations could be controlled by changing the design extraction ratio or gross thermal loading (Section 6.3.3.2.3, page 6-164, paragraph 9). However, the evaluations do not address the effects of heterogeneities on either creep, maintenance excavation requirements, waste package emplacement configuration, the design extraction ratio, and gross thermal loading on lateral extent. The NRC staff recognizes that there has been appropriate consideration of the lack of significant flexibility in selecting the depth of the underground openings. However, the NRC staff considers that the potential effect of heterogeneities in limiting the lateral flexibility of repository siting has not been considered.

Comment 5

Shaft Sealing - (Draft EA Major Comment 8)

Guidelines on Rock Characteristics 10 CFR 960.4-2-3(c)(1), (c)(3), and 10 CFR 960.5-2-9(c)(2)

In the NRC staff major comment 8 on the draft EA for Deaf Smith, concerns were raised that uncertainties and available evidence associated with constructing, sealing, and decommissioning shaft systems to assure containment and isolation of the waste were not adequately addressed. Review of the final EA indicates that, although the discussions on shaft construction were expanded (Section 4.1.2, pages 4-16 to 4-42), the information presented did not identify specific uncertainties described below related to effectiveness of existing ground freezing and sealing technology and factor them into the performance assessment of shaft seals.

The evaluation of in-situ characteristics and conditions which would require engineering measures beyond reasonably available technology in the construction of shafts does not address many of the sources of uncertainties associated with constructing shafts using reasonably available technology. The shaft construction concept presented in the final EA incorporates ground freezing technology to control rock movements and water flow. In the final EA (Section C.4.2.2, pages C.4-54 and 55), it is stated that vertical permeability changes during the thawing process are expected to be minimal due to the expected physical properties of the Ogallala and Dockum formations; however, no evaluation is presented of mechanisms of permeability increase for the site soil and rock materials experienced during freeze-thaw cycles. The final EA further states, in Section C.4.2.2, page C.4-55, that uniform thawing can be achieved. However, it is the opinion of the NRC staff that the heterogeneous physical nature of the ground to be frozen over a depth of 1000 feet, the unavoidable deviations in freeze holes alignment, variations in the zone disturbed by shaft excavation, and liner placement all suggest that both freezing and thawing will be non-uniform when shafts are constructed using currently available technology. Non-uniform freezing and thawing would result in uncertain reliability of freezewall performance and variability in parameter values required for engineering. Furthermore, no discussion is presented to show that the activities described in Section C.4.2.2, page C.4-55, and on page 6-164, intended to confine the zone disturbed by the freezing process, may be completed successfully using present state-of-the-art techniques. Likely increased permeability, associated with shaft freezing and thawing, could progressively reduce shaft integrity by introducing difficulties in achieving effective grouting and deleterious initial and long-term flow paths in penetrated strata. The final EA proposes the use of grouting to control water flows in shafts (Section 4.1.2.2.2, page 4-35, paragraph 4). It should be noted that in evaporite mines, it was reported that a need for recurrent grouting to maintain seal performance can be expected (ONWI-255, 1981, page 84). Furthermore, grouting processes are difficult to control particularly in deviatoric in-situ stress fields, where grouting can increase rather than decrease permeability (Houlsby, 1982, page 29). Also, it should be noted that in the final EA available evidence of shaft failures causing flooding (NRC major comment 8 on the draft EA) is dismissed as irrelevant to waste isolation in salt (Section C.5.11, page C.5-59), yet some completed shafts contemporary to the failures are cited (Section 4.1.2.2.2, Table 4-9, pages 4-37 through 4-39) as relevant to the state-of-the-art in shaft construction. Therefore, based on the limited information available and the reasons given above, the NRC staff considers that over the pre-closure period there may be an increasing probability of progressive seal and liner deterioration that could lead to groundwater inflow and possibly shaft failure.

The evaluation of rock conditions that could require engineering measures beyond reasonably available technology for the closure of a repository if such measures are necessary to ensure waste isolation did not recognize or factor in the following sources of uncertainty. Changes to the shaft system, which can be expected to occur during the pre-closure period (i.e., seal deterioration, leakage damage, liner deterioration, etc.) due to the groundwater flow, might adversely affect the performance of the decommissioning seal system. Sealing materials, which are not yet designed or developed for long term compatibility with engineering and chemical properties of disturbed shaft wall rock and grout materials, may prove ineffective due to uncertainties in the effects of aging on shaft system components. The response of shaft seals/walls to potential dynamic earthquake motions and the likelihood for damage to seals during both pre- and post-closure periods is also at present not clearly understood. Furthermore, decommissioning sealing of the repository with crushed salt backfill and bulkheads may, in some shafts/drifts, not effectively prevent shaft water from reaching the waste storage area. This is because consolidation of the backfill due to creep of the salt rock may not be sufficient to reduce permeability to desired levels as this is dependent on both placing the backfill at the correct density, and predicting the creep/closure of the drift walls, roof, and floor. Therefore, limited flow through decommissioned passages may be possible.

The NRC staff also considers that Sections 5.1.1.3, 5.1.4.2.2, and 6.3.1.3.3 in the final EA do not adequately address sources of uncertainty such as the potential thermally-induced ground movements that could result in deleterious strains in shaft linings and seals. Although surface uplifts predicted by thermoelastic analyses (Section 6.3.1.3.3, page 6-113) could be conservative, such analyses, when carried out for subsurface strata, may result in a non-conservative estimate of their thermomechanical response. For example, the potential for differential movement within the subsurface strata due to the effects of interbeds and discontinuities has not been evaluated. Such an analysis of the thermomechanical interaction of site stratigraphy, backfill, and shaft seal, including the nonlinear material behavior and properties of these system components, may well reveal deformation modes and differential movements which could affect shaft seal behavior. Furthermore, by omitting the effects of fractures, the analysis presented in Section 6.3.1.3.3, page 6-113 neither conservatively accounts for creation and dilation of fractures in shaft wall rock nor for distress of seals and linings. These omissions underestimate the potential for water migration through the shaft seal system. The NRC staff considers that an expected surface uplift above the shaft pillar centerline due to a 25 W/M^2 areal loading (as estimated in Wagner, et al., 1984, ONWI-512) may result in differential strains affecting post-closure shaft seal system performance. Differential displacement within the decommissioned shaft pillar region could result from small temperature changes due to the high coefficient of thermal expansion of salt.

Comment 6

Waste Package Performance Predictions - (Draft EA Comment 9)

Guidelines 10 CFR 960.4-2-2(b)(4), 960.4-2-2(c)(1) and 960.4-2-3(c)(1)

NRC staff concerns expressed in major comment 9 on the draft EA for the Deaf Smith County site that the performance of the engineered barrier system was based on a number of inadequately supported assumptions and that the uncertainties associated with these assumptions have not been adequately addressed. The NRC staff recognizes that the response in the final EA indicates that some specific areas of uncertainty in the analysis such as temperature profiles, radiation effects, solubilities, brine quantities, corrosion modes and performance models that were discussed in the draft EA comment will be addressed during site characterization (Sections 6.4.2.3.3, page 6-227, last paragraph, and 6.4.2.7, page 6-271, paragraph 2). However, examination of the final EA (Section 6.4.2, pages 6-193 to 6-243) indicates that the consequences of these assumptions and uncertainties on the analyses of waste package lifetime and radionuclide release rate have not been adequately addressed and, in large measure, the major comment on the draft EA continues to apply to the final EA.

The final EA recognizes that waste package design changes will be needed (Section 6.4.2.2.1, page 6-199) if the assumptions used in drawing conclusions regarding the post-closure guidelines (Sections 6.4.2.3.3, pages 6-217 to 6-232, and 6.4.2.3.4, pages 6-232 to 6-243) are not validated during site characterization activities (Appendix C, page C.5-44). However, the NRC staff continues to hold that the assumptions are not yet substantiated and the current range of uncertainties are not reflected in the conclusions. For example, the final EA continues to use the code BRINEMIG to model brine migration despite the fact that the code was developed using "assumptions... which do not realistically describe the movement of brine in salt" (Section C.5.11, page C.5-49). The model gave results for brine flow rates that were consistently less than observed results in in-situ heater experiments at the Waste Isolation Pilot Plant (WIPP) facility (Nowak, 1986). The use of BRINEMIG to conservatively predict brine migration rates is clearly questionable. In another example, the final EA continues to assume that brine entering a borehole will distribute itself uniformly over the overpack and that the overpack will corrode uniformly (Section 6.4.2.3.3, page 6-227). During the period the backfill remains as crushed salt, it is more likely that brine will collect at the bottom of each borehole and lead to corrosion over a limited portion of the overpack. As to the mode of corrosion, while uniform corrosion of overpack materials has been observed under some conditions (Kreiter, 1983; Westerman et al., 1983), the susceptibility of carbon steels to pitting corrosion, crevice corrosion, and stress-assisted cracking has been historically observed (Turnbull, 1983; Strutt et al., 1985; Ito et al., 1984; and Kruger, 1959) under other conditions. This observation raises significant questions regarding the long-term performance of the overpack. The final EA indicates that parametric studies have been performed (Section 6.4.2.3.3, page 6-232, paragraph 2) which use pitting ratios to account for the uncertainties in the uniform corrosion assumption. Neither the assumed pitting ratios nor the relationship between uniform and pitting or other localized corrosion process has yet been substantiated by data and analysis, but the final EA indicates (Section 6.4.2.3.3, page 6-232, paragraph 3) a high sensitivity of the computational results to non-uniform corrosion. Without adequate consideration of these alternative failure mechanisms, the NRC staff does not consider that the predicted 10,000 year container lifetime (which assumes uniform corrosion) reflects the current uncertainties.

REFERENCES

Andrews, R.W., Kelley, V.A., McNeish, J.A., LaVenue, A.M., and Campbell, J.E., 1985. Travel Path/Time Uncertainties at Salt Sites Proposed for High Level Waste Repositories: Prepared by Intera Technologies, Inc. for Office of Nuclear Waste Isolation, ONWI/E512-02900/TR-36.

Browning, R.E., 1985. Letter to R. Stein (DOE), June 12, 1985, regarding NRC position on groundwater travel time.

Budnik, Roy T., 1984. Structural Geology and Tectonic History of the Palo Duro Basin, Texas Panhandle, Bureau of Economic Geology OF-WTWI-1984-55, prepared for U.S. Department of Energy by The University of Texas at Austin, Austin, TX.

D'Appolonia Consulting Engineers, 1981. "Sealing Considerations for Repository Shafts in Bedded and Dome Salt," ONWI-255, Office of Nuclear Waste Isolation, Battelle Memorial Institute, Columbus, OH, p. 84.

Finley, Robert J., and Thomas C. Gustavson, 1981. Lineament Analysis Based on LANDSAT Imagery, Texas Panhandle, Geological Circular 81-5, prepared for U.S. Department of Energy by Bureau of Economic Geology, The University of Texas at Austin, Austin, TX.

Gustavson, Thomas C., Robert J. Finley, and Robert W. Baumgardner, Jr., 1981. "Retreat of the Caprock Escarpment and Denudation of the Rolling Plains in the Texas Panhandle," Bulletin of the Association of Engineering Geologists, Vol. 18, No. 4, pp. 413-422.

Gustavson, Thomas C., and Roy J. Finley, 1984. Late Cenozoic Geomorphic Evolution of the Texas Panhandle and Northeastern New Mexico - Case Studies of Structural Controls and Regional Drainage Development, Bureau of Economic Geology OF-WTWI-1984-39, prepared for U.S. Department of Energy by The University of Texas at Austin, Austin, TX.

Gustavson, Thomas C., and Roy T. Budnik, 1984. Salt Dissolution: Examples from Beneath the Southern High Plains, OF-WTWI-1984-3, prepared for U.S. Department of Energy by Bureau of Economic Geology, The University of Texas at Austin, Austin, TX.

Gustavson, Thomas C., and Roy T. Budnik, 1985. "Structural Influences on Geomorphic Processes and Physiographic Features, Texas Panhandle: Technical Issues in Siting a Nuclear Waste Repository," Geology, Vol. 13, pp. 173-176.

Gustavson, Thomas C., and Vance T. Holliday, 1985. Depositional Architecture of the Quaternary Blackwater Draw and Tertiary Ogallala Formations, Texas Panhandle and Eastern New Mexico, OF-WTWI-1985-23, prepared for U.S. Department of Energy by Bureau of Economic Geology, The University of Texas at Austin, Austin, TX.

Houlsby, A.C. "Cement Grouting for Dams," in ASCE "Proceedings of the Conference on Grouting in Geotechnical Engineering," 1982, New Orleans, LA, p. 29.

Hovorka, Susan D., B.A. Luneau, and S. Thomas, 1985. Stratigraphy of Bedded Halite in the Permian San Andres Formation, Units 4 and 5, Palo Duro Basin, Texas (draft), OF-WTWI-1985-9, prepared for the U.S. Department of Energy by Bureau of Economic Geology, The University of Texas at Austin, Austin, TX, Plates 2 and 10.

Ito, S., T. Murata and H. Okada, 1984. "A Statistical Approach to Corrosion of Marine Steel Structures," International Congress on Metallic Corrosion, Toronto, June 3-7.

Johns, Davis A., 1985. Sandstone Distribution and Lithofacies of the Triassic Dockum Group, Palo Duro Basin, Texas (draft), OF-WTWI-1985-25, prepared for U.S. Department of Energy by Bureau of Economic Geology, The University of Texas at Austin, Austin, TX.

Kreiter, M.R., 1983, "Waste Package Program," Section 3.1.1 in J.L. McElroy and J.A. Powell, compilers, Nuclear Waste Management Semiannual Progress Report, April 1983 through September 1983, PNL-4250-4, prepared for U.S. Department of Energy by Pacific Northwest Laboratory, Battelle Memorial Institute, Richland, WA, pp. 3.1-3.29.

Kruger, J., 1959. "Influence of Crystallographic Orientation on the Pitting of Iron in Distilled Water," Journal of the Electrochemical Society, Vol. 106, No. 8, p. 736.

Nowak, E.J., 1986. Preliminary Results of Brine Migration Studies in the Waste Isolation Pilot Plant (WIPP), Sandia National Laboratories Report SAND86-0720, Albuquerque, NM.

Regan, Terence R., and Philip J. Murphy, 1984. Structural Analysis of the Northern Palo Duro Basin, prepared by Stone & Webster Corporation for Office of Nuclear Waste Isolation, Battelle Memorial Institute, Columbus, OH, Figure 3, in preparation.

Strutt, J.E., J.R. Nicholls and B. Barbier, 1985. "The Prediction of Corrosion by Statistical Analysis of Corrosion Profiles," Corrosion Science, Vol. 25, No. 5, pp. 305-315.

Thompson, B.M., Campbell, J.E., and Lognsine, D.E., 1985. PTRACK; A Particle Tracking Program for Evaluating Travel Path/Time Uncertainties: Prepared by Intera Technologies, Inc. for Office of Nuclear Waste Isolation, ONWI/E512-02900/CD-27.

Turnbull, A., 1983. "The Solution Composition and Electrode Potential in Pits, Crevices and Cracks," Corrosion Science, Vol. 23, No. 8, pp. 833-870.

U.S. Department of Energy, 1984. "Nuclear Waste Policy Act of 1982; General Guidelines for the Recommendation of Sites for the Nuclear Waste Repositories; Final Siting Guidelines," (10 CFR Part 960), Federal Register, Vol. 49, pp. 47714-47770, Washington, DC, December 6.

U.S. Department of Energy, 1984. Draft Environmental Assessment, Deaf Smith County Site, Texas, Office of Civilian Radioactive Waste Management, Washington, DC.

U.S. Department of Energy, 1986. Final Environmental Assessment, Deaf Smith County Site, Texas, Office of Civilian Radioactive Waste Management, Washington, DC.

U.S. Nuclear Regulatory Commission, 1985. NRC Staff Comments on the DEA for Deaf Smith County Site, Texas, Office of Nuclear Material Safety and Safeguards, Washington, DC.

U.S. Nuclear Regulatory Commission, 1986. "Disposal of High-Level Radioactive Wastes in Geologic Repositories," 10 CFR Part 60, Subpart E, Technical Criteria. Code of Federal Regulations - Energy. Office of the Federal Register, Washington, DC.

U.S. Nuclear Regulatory Commission, 1986. "Draft Generic Technical Position on Groundwater Travel Time (GWTT)," Office of Nuclear Material Safety and Safeguards, Washington, DC, July 1986.

U.S. Nuclear Regulatory Commission and U.S. Department of Energy, Permian Basin Core Examination Summary, August 5-9, 1985, Texas Bureau of Economic Geology Offices, Austin, TX.

Wagner, R.A., M.C. Loken and H.Y. Tammemagi, 1984. "Preliminary Thermomechanical Analyses of a Conceptual Nuclear Waste Repository at Four Salt Sites," ONWI-512, Office of Nuclear Waste Isolation, Battelle Memorial Institute, Columbus, OH, 228 p.

Westerman, R.E., J.L. Nelson, S.G. Pitman, W.L. Kuhn, S.J. Basham and D.P. Novak, 1983. Evaluation of Iron Base Materials for Waste Package Containers in a Salt Repository, PNL-SA-11713, Paper D5.10, by Pacific Northwest Laboratory and Nuclear Waste Isolation, Battelle Memorial Institute, presented at Materials Research Society Annual Meeting, Boston, MA, November 14-17.

MAJOR COMMENTS
ON
RICHTON DOME SITE

Comment 1

Redox Conditions - (Draft EA Major Comment 4)

Guidelines on Geochemistry 10 CFR 960.4-2-2(b)(2),(c)(3)

In the NRC staff major comment 4 on the draft EA for Richton Dome, concerns were raised that the limitations in current evidence regarding processes that affect radionuclide migration, such as precipitation, sorption, radiocolloid formation, and organo-radionuclide complexation were not factored into estimates of the above parameters which may lead to underestimations of radionuclide mobility. Examination of the final EA indicates that discussions of sorption, radiocolloid formation, and organo-radionuclide complexation have been adequately revised to include discussions of uncertainties in the data (Section 6.3.1.2.2, pages 6-95 to 6-96, items 3 through 6); however, concerns with redox conditions have not been factored into discussions and evaluations presented in the final EA regarding the mobility of redox-sensitive radionuclides (Section 6.3.1.2.2, pages 6-94 to 6-95, items 1 and 2; Section 6.3.1.2.3, page 6-99, paragraph 3).

The NRC staff is concerned that evidence presented in the final EA does not support the conclusion that the groundwater adjacent to the Richton Dome is chemically reducing. The final EA presents Eh values of -50 to -100 millivolts for the groundwater in the Upper Aquifer if suspect higher values are discarded (Section 6.3.1.2.2, page 6-95, item 2). Difficulties in obtaining reliable Eh measurements have been identified by Lindberg and Runnells (1984) which result in significant uncertainty in any Eh measurement. Such uncertainty of Eh measurements of the groundwater is recognized in the final EA where it is stated "reliable Eh measurements of groundwater is problematic" (Section 6.3.1.2.2, page 6-95, item 2). The final EA also states that the presence of reducing mineral assemblages, dissolved gases, and organics is qualitative evidence of chemically reducing conditions in both the Richton Dome salt and in groundwaters adjacent to the dome (Section 6.3.1.2.2, pages 6-94 to 6-95, items 1 and 2; Section 6.3.1.2.3, page 6-99, paragraph 3). The NRC staff is concerned that the presence of reducing mineral assemblages, dissolved gases, and organics, although indirect evidence of reducing conditions, is not conclusive because these components can exist metastably under oxidizing conditions. This possibility is not discussed in the final EA. Due to the uncertainties of the evidence presented, the existence of reducing or oxidizing conditions cannot be stated unequivocally in the absence of analyses which establish a consistency between various types of quantitative data.

Even assuming that reducing conditions are present, no evidence is presented in the final EA to show that redox-sensitive radionuclides released from the waste form will be reduced. If redox-sensitive actinide elements are dissolved from the waste form in the oxidized state, kinetic effects may prevent the establishment of redox equilibria and inhibit the transformation of oxidized actinide species to reduced species, which tend to be less mobile. This is of major concern regarding long-term release to the accessible environment because redox-sensitive radionuclides such as plutonium, uranium, neptunium, and technetium have long half-lives. No evidence is presented to suggest how kinetic constraints will be overcome. Furthermore, contradictory statements regarding redox conditions are made. It is stated in the final EA that the oxidized species $UO_2(CO_3)_3^{4-}$ "can be thermodynamically stable under reducing conditions" (Section 6.3.1.2.2, page 6-96, item 5); elsewhere, however, it is stated that reducing conditions expected in the host salt "will promote the precipitation of many redox-sensitive radionuclides" (Section 6.3.1.2.2, page 6-94, item 1) and "redox-sensitive radionuclides are expected to be stable in their lower oxidation states" (Section 6.3.1.2.2, page 6-95, item 2). The NRC staff considers that the conclusion that redox-sensitive radionuclides will be in reduced states is premature because the field data on redox conditions are limited and highly uncertain and there is a lack of experimental studies investigating redox equilibria under chemical conditions expected in a repository.

Precipitation of radionuclides in the host salt and outside the host salt is an important process affecting radionuclide migration (Section 6.3.1.2.2, pages 6-94 to 6-95, items 1 and 2). Effective precipitation of redox-sensitive radionuclides is dependent on their being in a reduced state. The NRC staff believes that factoring uncertainties regárding redox conditions into the analysis can also support an alternative assumption that redox-sensitive radionuclides might remain in the more mobile oxidized state during the isolation time period.

Comment 2

Effects of Host Rock Mass Heterogeneity - (Draft EA Major Comment 5)

Guidelines on Rock Characteristics 10 CFR 960.4-2-3(b)(1), (b)(2), (c)(1), (c)(3) and 10 CFR 960.5-2-9(b)(1), (c)(2)

In the NRC staff major comment 5 on the draft EA for Richton Dome, concerns were raised that the existence of heterogeneities and large anomalies within the Richton Dome were not acknowledged and the possible effects of such heterogeneities were not adequately considered in the evaluation of rock characteristics related to availability of suitable host rock and the level of complexity of technology needed for construction, operation, and closure of the repository. Review of the final EA indicates that the likelihood of heterogeneities and anomalies within the Richton Dome has been acknowledged (Section 3.2.3.2.4, page 3-30, third paragraph; Section 3.2.6.1.2, page 3-54, paragraphs 4 through 6; Section 6.3.1.3, page 6-102, paragraphs 1 and 5; Section 6.3.3.2.4, page 6-167, fourth paragraph). Review also indicates that the assessment of geomechanical properties of cap rock and salt (Section 3.2.6.1.2) has been expanded to consider the possible influence of discontinuities on mining operations (page 3-60). However, the NRC staff continues to question whether the possible thermal and geomechanical effects of heterogeneities have been conservatively factored into evaluations of repository construction, operation, and maintenance.

With respect to conclusions based on the thermal and ductility properties of the host rock mass, the final EA presents estimates of physical, thermal, and mechanical properties of the Richton Dome salt (Sections in 3.2.6.1.2 and 3.2.6.2, Tables 3-7, 3-8, and 3-10, pages 3-55 to 3-64) as representative of the host rock mass. These estimates draw upon limited laboratory testing of salt rock cores taken from a single borehole (MRIG-9). It also appears that the data used (Tables 3-7, 3-8, and 3-10) in rock characteristic evaluations was for essentially pure salt rock. Therefore, these samples may not fully represent in situ host rock mass at the site and have resulted in an implicit assumption of homogeneity. While the final EA correctly identified that the dome's internal structure is typically steeply dipping and that data from a single borehole cannot be considered representative of the entire salt stock (page 6-102, top of page), the uncertainties related to the adverse effects of heterogeneities were not factored into the evaluations. The engineering behavior of the in-situ rock mass, especially under waste-induced thermomechanical loading, can be dominated by heterogeneities. Because of the present lack of location and parametric data on heterogeneities and anomalies at the Richton Dome site and the resulting uncertainties associated with the analyses performed to evaluate the impact of those heterogeneities and anomalies on the performance of the geologic repository, the NRC staff considers that substantial uncertainties remain that were not factored into the final EA evaluations of (1) rock mass physical, thermal, and engineering properties, (2) the extent of the disturbed zone, (3) opening stability, (4) rock support requirements and (5) flexibility in locating the underground facility.

The evaluation of in-situ characteristics or conditions that could require engineering measures beyond reasonably available technology in the construction of the shafts and underground facilities does not reflect requisite consideration of the special demands that probable rock mass heterogeneities and large anomalies may make on the requirement for engineering measures when constructing adjacent to areas of emplaced waste. Opening stability may be adversely affected and may necessitate increased requirements for complex roof support and reinforcement. The potential adverse effects of heterogeneities and anomalies might also extend the disturbed zone beyond the 15 meters estimated in Appendix 6A of the final EA (page 6A-7).

The evaluation of conditions requiring engineering measures beyond reasonably available technology for construction, operation, and closure if such measures are necessary for waste containment and isolation presented on pages 6-103 and 6-104 does not include an analysis of the influence of heterogeneities on the requirements for engineering measures beyond reasonably available technology. Areas of particular concern include: (a) lack of analysis of the engineering behavior of heterogeneous salt and large anomalous zones under anticipated repository environmental conditions; (b) the lack of an analysis of the relevance of cited excavation technology and experience which is limited to the ambient conditions to the full range of expected repository host rock thermomechanical behavior conditions; and (c) lack of analysis of requirements for a retrieval system.

The evaluation of the existence of geologic structure, material properties, and hydrologic conditions such that the heat generated by emplaced waste could reduce isolation does not show that the effects of heterogeneities and large anomalies on the thermal and mechanical properties of the host rock and on porosity increases, or on ground movements due to emplaced waste heat would necessarily be localized or negligible. The effects of heterogeneities and large anomalies on characterization of the salt rock response to thermal loading, the potential for non-uniform response of cap rock and overlying strata to thermal loading, and the potential for differential transfer of stresses and strains in the cap rock and overlying materials, both within and outside the thermal pulse, have all not been addressed. If experienced, these effects might decrease the isolation provided by the host rock as compared with pre-waste-emplacement conditions.

Finally, the evaluations of host rock thickness and lateral extent to allow sufficient flexibility in selecting depth, configuration, and location of the underground facility do not reflect consideration of some of the potential effects of heterogeneities and anomalous zones in the host rock which would limit the available lateral extent of host rock needed for locating the underground facility and providing an adequate buffer zone beyond the limits of the underground facility. Heterogeneity effects that may impact lateral flexibility are: (1) gassy mine conditions, (2) anomalous zone(s) larger than that assumed in the final EA (page 6-102), and (3) reduced thermal loading. It may be necessary to reduce areal thermal loading to account for uncertainties in thermal conductivity (either due to heterogeneities or conservative application of laboratory values) as suggested in the final EA (page C.5-43). This would result in an increase of areal requirement of the underground facility. In addition, the two-phase repository concept would increase the total area required by 34 percent (Table 5-1, page 5-7, final EA). The NRC staff considers that, because significant potential effects of heterogeneities and anomalous zones that could limit the lateral flexibility of repository siting have not been considered, the evaluations do not reflect an appropriate conservative approach.

Comment 3

Shaft Sealing - (Draft EA Major Comment 7)

Guidelines on Rock Characteristics 10 CFR 960.4-2-3(c)(1), (c)(3), and 10 CFR 960.5-2-9(c)(2)

In the NRC staff major comment 7 on the draft EA for Richton Dome, concerns were raised that uncertainties and available evidence associated with constructing, sealing, and decommissioning shaft systems to assure containment and isolation of the waste were not adequately addressed. Review of the final EA indicates that, although the discussions on shaft construction were expanded (Section 4.1.2, pages 4-17 to 4-42), the information presented did not identify specific uncertainties described below related to effectiveness of existing ground freezing and sealing technology and factor them into the performance assessment of shaft seals.

The evaluation of in-situ characteristics and conditions which would require engineering measures beyond reasonably available technology in the construction of shafts does not address many of the sources of uncertainties associated with constructing shafts using readily available technology. The shaft construction concept presented in the final EA incorporates ground freezing technology to control rock movements and water flow. In the final EA (Section 4.1.2.2.2, page 4-37 and Section C.8.3, page C.8-10), it is stated that soils could experience vertical permeability increases during thawing, and that the effect has been shown to be highest in fine-grained, plastic clays. The final EA presents no thorough evaluation of mechanisms of permeability increase for the site soil and rock materials which may experience freeze-thaw cycles. The final EA further states, on page 4-37, that uniform thawing can be achieved. However, it is the opinion of the NRC staff that the heterogeneous physical nature of the ground to be frozen, the unavoidable deviations in freeze hole alignment, and variations in the zone disturbed by shaft excavation and liner placement all suggest that both freezing and thawing will be non-uniform when shafts are constructed using currently available technology. Non-uniform freezing and thawing would result in uncertain reliability of freezewall performance and variability in parameter values required for engineering. Furthermore, no discussion is presented to show that the activities described on page 4-37, and on page 6-164, intended to confine the zone disturbed by the freezing process, may be completed successfully using present state-of-the-art techniques. Likely increased permeability, associated with shaft freezing and thawing, could progressively reduce shaft integrity by introducing difficulties in achieving effective grouting and deleterious initial and long-term flow paths in penetrated strata. The final EA proposes the use of grouting to control water flows in shafts (page 4-37, paragraph 2). It should be noted that in evaporite mines, it was reported that a need for recurrent grouting to maintain seal performance can be expected (ONWI-255, 1981, page 84). Furthermore, grouting processes are difficult to control particularly in deviatoric in-situ stress fields, where grouting can increase rather than decrease permeability (Houlsby, 1982). Also, it should be noted that in the final EA available evidence of shaft failures causing flooding (NRC major comment 7 on the draft EA) is dismissed as irrelevant to waste isolation in salt (Section C.5.11, page C.5-50), yet some completed shafts contemporary to the failures are cited (Section 4.1.2.2.2, Table 4-9, pages 4-39 through 4-41) as relevant to the state-of-the-art in shaft construction. Therefore, based on the limited information available and the reasons given above, the NRC staff considers that over the pre-closure period there may be an increasing probability of progressive seal and lining deterioration that could lead to groundwater inflow and possibly shaft failure.

he evaluation of rock conditions that could require engineering measures beyond reasonably available technology for the closure of a repository if such measures are necessary to ensure waste isolation did not recognize or factor in the following sources of uncertainty. Changes to the shaft system, which can be expected to occur during the pre-closure period (i.e., seal deterioration, leakage damage, liner deterioration, etc.) due to the groundwater flow, might adversely affect the performance of the decommissioning seal system. Sealing materials, which are not yet designed or developed for long-term compatibility with engineering and chemical properties of disturbed shaft wall rock and grout materials, may prove ineffective due to uncertainties in the effects of aging of shaft components. The response of shaft seals/walls to potential dynamic earthquake motions and the likelihood for damage to seals during both pre- and post-closure periods is also at present not clearly understood. Furthermore, decommissioning sealing of the repository with crushed salt backfill and bulkheads may in some shafts/drifts not effectively prevent water in the shaft from reaching the waste storage area. This is because creep consolidation of the backfill may not be sufficient to reduce permeability to desired levels as this is dependent on both placing the backfill at the correct density and predicting the creep/closure of the drift walls, roof, and floor. Therefore, limited flow through decommissioned passages may be possible.

The NRC staff also considers that Sections 5.1.1.3, 5.1.4.2.2, and 6.3.1.3.3 in the final EA do not adequately address sources of uncertainty such as the potential thermally-induced ground movements that could result in deleterious strains in shaft linings and seals. Although surface uplifts predicted by thermoelastic analyses (page 6-105) could be conservative, such analyses, when carried out for cap rock and subsurface strata above it, may result in a non-conservative estimate of their thermomechanical response. For example, the potential for differential movement within the subsurface strata due to the effects of discontinuities has not been evaluated. Such an analysis of the thermomechanical interaction of site stratigraphy, backfill, and shaft seal, including the non-linear material behavior and properties of these system components, may well reveal deformation modes and differential movements which could affect shaft seal behavior. Furthermore, by omitting the effects of fractures, the analysis presented in Section 6.3.1.3.3 (page 6-105) neither conservatively account for creation and dilation of fractures in shaft wall rock nor evaluate the potential for distress of seals and linings. These omissions underestimate the potential for water migration through the shaft seal system. The NRC staff considers that an expected surface uplift above the shaft pillar centerline due to a 25 W/M^2 areal loading (as estimated in Wagner, et al., 1984, ONWI-512) may result in differential strains affecting post-closure shaft seal system performance. Even small temperature changes combined with the high coefficient of thermal expansion of salt could result in differential displacement within the decommissioned shaft pillar region.

Comment 4

Waste Package Performance Predictions - (Draft EA Comment 9)

Guidelines 10 CFR 960.4-2-2(b)(4), 960.4-2-2(c)(1) and 960.4-2-3(c)(1)

NRC staff concerns expressed in major comment 9 on the draft EA for the Richton Dome site that the performance of the engineered barrier system was based on a number of inadequately supported assumptions and that the uncertainties associated with these assumptions have not been adequately addressed. The NRC staff recognizes that the response in the final EA indicates that some specific areas of uncertainty in the analysis such as temperature profiles, radiation effects, solubilities, brine quantities, corrosion modes and performance models that were discussed in the draft EA comment will be addressed during site characterization (Sections 6.4.2.3.3, page 6-230, second paragraph, and 6.4.2.7, page 6-260, paragraph 2). However, examination of the final EA (Section 6.4.2, pages 6-193 to 6-260) indicates that the consequences of these assumptions and uncertainties on the analyses of waste package lifetime and radionuclide release rate have not been adequately addressed and, in large measure, the major comment on the draft EA continues to apply to the final EA.

The final EA recognizes that waste package design changes will be needed (Section 6.4.2.2.1, page 6-199) if the assumptions used in drawing conclusions regarding the post-closure guidelines (Sections 6.4.2.3.3, pages 6-212 to 6-230, and 6.4.2.3.4, pages 6-230 to 6-241) are not validated during site characterization activities (Appendix C, page C.5-36). However, the NRC staff continues to hold that the assumptions are not yet substantiated and the current range of uncertainties are not reflected in the conclusions. For example, the final EA continues to use the code BRINEMIG to model brine migration despite the fact that the code was developed using "assumptions... which do not realistically describe the movement of brine in salt" (Section C.5.11, page C.5-41). The model gave results for brine flow rates that were consistently less than observed results in in-situ heater experiments at the Waste Isolation Pilot Plant (WIPP) facility (Nowak, 1986). The use of BRINEMIG to conservatively predict brine migration rates is clearly questionable. In another example, the final EA continues to assume that brine entering a borehole will distribute itself uniformly over the overpack and that the overpack will corrode uniformly (Section 6.4.2.3.3, page 6-230). During the period the backfill remains as crushed salt, it is more likely that brine will collect at the bottom of each borehole and lead to corrosion over a limited portion of the overpack. As to the mode of corrosion, while uniform corrosion of overpack materials has been observed under some conditions (Kreiter, 1983; Westerman et al., 1983), the susceptibility of carbon steels to pitting corrosion, crevice corrosion, and stress-assisted cracking has been historically observed (Turnbull, 1983; Strutt et al., 1985; Ito et al., 1984; and Kruger, 1959) under other conditions. This observation raises significant questions regarding the long-term performance of the overpack. The final EA indicates that parametric studies have been performed (Section 6.4.2.3.3, page 6-230, paragraph 2) which use pitting ratios to account for the uncertainties in the uniform corrosion assumption. Neither the assumed pitting ratios nor the relationship between uniform and pitting or other localized corrosion process has yet been substantiated by data and analysis. Without adequate consideration of these alternative failure mechanisms, the NRC staff does not consider that the predicted 10,000 year container lifetime (which assumes uniform corrosion) reflects the current uncertainties.

REFERENCES

D'Appolonia Consulting Engineers, 1981. "Sealing Considerations for Repository Shafts in Bedded and Dome Salt," ONWI-255, Office of Nuclear Waste Isolation, Battelle Memorial Institute, Columbus, OH, p. 84.

Houlsby, A.C. "Cement Grouting for Dams," in ASCE "Proceedings of the Conference on Grouting in Geotechnical Engineering," 1982, New Orleans, LA, p. 29.

Ito, S., T. Murata and H. Okada, 1984. "A Statistical Approach to Corrosion of Marine Steel Structures," International Congress on Metallic Corrosion, Toronto, June 3-7.

Kreiter, M.R., 1983, "Waste Package Program," Section 3.1.1 in J.L. McElroy and J.A. Powell, compilers, Nuclear Waste Management Semiannual Progress Report, April 1983 through September 1983, PNL-4250-4, prepared for U.S. Department of Energy by Pacific Northwest Laboratory, Battelle Memorial Institute, Richland, WA, pp. 3.1-3.29.

Kruger, J., 1959. "Influence of Crystallographic Orientation on the Pitting of Iron in Distilled Water," Journal of the Electrochemical Society, Vol. 106, No. 8, p. 736.

Lindberg, R.D., and D.D. Runnells, 1984, "Ground Water Redox Reactions: An Analysis of Equilibrium State Applied to Eh Measurements and Geochemical Modeling," Science, v. 225, p. 925-927.

Nowak, E.J., 1986. Preliminary Results of Brine Migration Studies in the Waste Isolation Pilot Plant (WIPP), Sandia National Laboratories Report SAND86-0720, Albuquerque, NM.

Strutt, J.E., J.R. Nicholls and B. Barbier, 1985. "The Prediction of Corrosion by Statistical Analysis of Corrosion Profiles," Corrosion Science, Vol. 25, No. 5, pp. 305-315.

Turnbull, A., 1983. "The Solution Composition and Electrode Potential in Pits, Crevices and Cracks," Corrosion Science, Vol. 23, No. 8, pp. 833-870.

Wagner, R.A., M.C. Loken and H.Y. Tammemagi, 1984. "Preliminary Thermomechanical Analyses of a Conceptual Nuclear Waste Repository at Four Salt Sites," ONWI-512, Office of Nuclear Waste Isolation, Battelle Memorial Institute, Columbus, OH, 228 p.

Westerman, R.E., J.L. Nelson, S.G. Pitman, W.L. Kuhn, S.J. Basham and D.P. Novak, 1983. Evaluation of Iron Base Materials for Waste Package Containers in a Salt Repository, PNL-SA-11713, Paper D5.10, by Pacific Northwest Laboratory and Nuclear Waste Isolation, Battelle Memorial Institute, presented at Materials Research Society Annual Meeting, Boston, MA, November 14-17.

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May 8, 1987

The Honorable J. Bennett Johnston
Chairman
Committee on Energy and Natural
Resources
SD-364 Dirksen Senate Office
Building
Washington, D.C. 20510

Dear Mr. Chairman:

On behalf of the American Public Power Association, the national service organization that represents 1,750 local, publicly owned electric utilities, I respectfully request that this letter and enclosures be made part of the Senate Energy Committee's hearing record on implementation of the Nuclear Waste Policy Act of 1982.

APPA supports the Nuclear Waste Policy Act as enacted, which includes authorization of a permanent waste repository, a site selection process for a second repository, and a study of the need for a monitored retrievable storage (MRS) facility. (APPA's resolution is attached.) We urge Congress to take appropriate action to ensure timely completion of a permanent waste disposal program.

We cannot support the draft mission plan amendment which alters the NWPA by postponing operation of the first repository for five years, until the year 2003, and operation of the second repository until at least the year 2023.

APPA is interested in the implementation of the Nuclear Waste Policy Act in a timely fashion because 38 public power systems either own or operate nuclear powerplants or jointly own nuclear powerplants built and operated by other utilities. (Table attached.) Other public power systems have executed life-of-unit agreements for capacity in nuclear powerplants, and still others purchase nuclear-generated power at wholesale.

The Honorable J. Bennett Johnston
May 8, 1987
Page Two

It is our belief that in order for nuclear power to remain a viable energy option, it is necessary that a technically sound and publicly acceptable method to dispose of nuclear waste be developed as soon as possible. To this end, we have urged DOE to move ahead with a permanent waste disposal program as mandated in NWPA.

The nuclear waste program is solely funded by nuclear utility contributions obtained from ratepayers. The NWPA represents a bargain between DOE and consumers of nuclear utilities that requires utilities to pay into the waste fund years in advance of a permanent waste repository, with the expectation that DOE will begin receiving spent fuel in 1998.

To date, utilities have paid $2.7 billion into the program. Ratepayers' money continues to go into the nuclear waste fund, and yet there is doubt as to whether the program can advance in a timely manner so that DOE can begin accepting nuclear waste. Clearly, consumers of nuclear utilities are not receiving the benefit of their bargain.

Several statutory deadlines for implementation of the NWPA have been missed. Further delays mean inherent cost increases for utilities and their ratepayers. In the meantime, nuclear utilities are accumulating spent fuel at their reactor sites. As on-site storage capacity diminishes, utilities face the serious question of what to do with the accumulated waste. Utilities and the public are now questioning whether there will be a permanent repository or whether each reactor site will be a de facto waste site.

APPA believes that further delays in implementing the nuclear waste program will jeopardize the future of the NWPA, destroy public confidence in the ability of the government and industry to provide a permanent solution for nuclear waste, and create uncertainty for utilities now accumulating waste in on-site storage facilities.

Again, we emphasize the need for the nuclear waste program to move ahead. We urge the Senate Energy Committee to direct DOE to carry out the plan as enacted under the Nuclear Waste Policy Act.

Sincerely,

Larry Hobart
Larry Hobart
Executive Director

LH/sm
enclosure

cc: Members, Senate Energy Committee

NUCLEAR WASTE

WHEREAS, if nuclear power is to remain a viable energy option, it is essential to provide a technically sound and publicly acceptable system for the storage of spent fuel and the disposal of radioactive waste, and

WHEREAS, in 1982, APPA supported passage of the Nuclear Waste Policy Act, which included creation of a permanent waste repository, a selection process for a second repository, a study on the need for a monitored retrievable storage (MRS) facility, and funding by utilities and other users, and

WHEREAS, in April, 1985, the President approved commingling defense and civilian waste, and, pursuant to NWPA, the federal government is now obligated to pay the costs resulting from the disposal of defense waste, and

WHEREAS, DOE's selection of Texas, Nevada, and Washington as three candidate sites for the first site and the indefinite postponement of a second location have raised questions as to whether the process is based on objective criteria, and has led to Congress' reducing program funds, and

WHEREAS, utilities have been funding the nuclear waste program since 1983 while an equitable formula for allocation of repository costs for defense waste has not been devised, and

WHEREAS, further delays in implementing the program will result in longer project time with inherent cost increases, undermine public confidence in the ability of the government and the industry to provide a timely, permanent solution for nuclear waste, and create uncertainty for utilities that are now accumulating waste in on-site storage facilities;

NOW, THEREFORE, BE IT RESOLVED: that the American Public Power Association:

1. Reaffirms support for the permanent repository endorsed in the NWPA, which includes a site selection process for two repository sites and a study for a monitored retrievable storage (MRS) facility;
2. Urges DOE and Congress to take appropriate action to ensure timely completion of a permanent waste disposal program;
3. Asks DOE to calculate an equitable and appropriate share of the cost of the program for defense waste so that such fees can be collected as soon as possible.

-- Adopted by the Legislative and Resolutions Committee of the American Public Power Association at its meeting March 4, 1987, in Washington, D.C.

NUCLEAR POWERPLANT OWNERSHIP BY PUBLICLY OWNED ELECTRIC UTILITY SYSTEMS

Prepared by the
AMERICAN PUBLIC POWER ASSOCIATION
March, 1987

Publicly Owned Utility System (By State)	Plant	Status 1/	Capacity (MWe) 2/	Public System's Share of Plant: % Share	MWe Share
A. LOCAL AND STATE PUBLIC POWER SYSTEMS					
Salt River Project (AZ)	Palo Verde 1-3	CO (1986, 1986); CP (1987)	3,663 *	17.5	641.03
City of Anaheim (CA) Public Utilities	San Onofre 2, 3	CO (1983, 1984)	2,150 *	3.16	67.94
Los Angeles (CA) Department of Water and Power	Palo Verde 1-3	CO (1986, 1986); CP (1987)	3,663 *	5.7	208.79
City of Riverside (CA) Public Utilities	San Onofre 2, 3	CO (1983, 1984)	2,150 *	1.79	38.49
Sacramento (CA) Municipal Utilities District	Rancho Seco 1	CO (1975)	913	100.0	913.00
Southern California Public Power Authority	Palo Verde 1-3	CO (1986, 1986); CP (1987)	3,663 *	5.9	216.12
Connecticut Municipal Electric Energy Cooperative	Millstone 3	CO (1986)	1,150	1.0435	12.00
City of Alachua (FL)	Crystal River 3	CO (1977)	825	0.0779	0.64

Publicly Owned Utility System (By State)	**Plant**	**Status 1/**	**Capacity (MWe) 2/**	**Public System's Share of Plant:**	
				% Share	**MWe Share**
Bushnell (FL) Utilities	Crystal River 3	CO (1977)	825	0.0388	0.32
Florida Municipal Power Agency	St. Lucie 2	CO (1983)	855 **	8.806	75.29
Gainesville (FL) Regional Utilities	Crystal River 3	CO (1977)	825	1.407	11.61
Kissimmee (FL) Utilities	Crystal River 3	CO (1977)	825	0.6754	5.57
City of Leesburg (FL)	Crystal River 3	CO (1977)	825	0.8244	6.80
New Smyrna Beach (FL) Utilities Commission	Crystal River 3	CO (1977)	825	0.5608	4.63
Ocala (FL) Electric Utilities	Crystal River 3	CO (1977)	825	1.3333	11.00
Orlando (FL) Utilities Commission	Crystal River 3 St. Lucie 2	CO (1977) CO (1983)	825 852 **	1.6015 6.08951	13.21 51.88
Sebring (FL) Utilities	Crystal River 3	CO (1977)	825	0.4473	3.69
City of Tallahassee (FL)	Crystal River 3	CO (1977)	825	1.3333	11.00
Dalton (GA) Utilities	Vogtle 1, 2 Hatch 1, 2	CP (1987, 1988) CO (1975, 1979)	2,300 1,620	1.6 2.2	36.80 35.64
Municipal Electric Authority of Georgia	Vogtle 1, 2 Hatch 1, 2	CP (1987, 1988) CO (1975, 1979)	2,300 1,620	22.7 17.7	522.10 286.74
Chicopee (MA) Municipal Light Plant	Millstone 3	CO (1986)	1,150	1.35	15.53

Publicly Owned Utility System (By State)	Plant	Status 1/	Capacity (MWe) 2/	Public System's Share of Plant:	
				% Share	MWe Share
Town of Hudson (MA) Light and Power	Seabrook 1	CP (date uncertain)	1,150	0.08	.92
Massachusetts Municipal Wholesale Electric Company	Seabrook 1	CP (date uncertain)	1,150	11.59	133.29
	Millstone 3	CO (1986)	1,150	4.8	55.20
Taunton (MA) Municipal Lighting Plant	Seabrook 1	CP (date uncertain)	1,150	0.1	1.15
Lincoln (NE) Electric System	Cooper	CO (1974)	778	3/	3/
Nebraska Public Power District	Cooper	CO (1974)	778	50.0	389.00
Omaha Public Power District (NE)	Fort Calhoun 1	CO (1973)	476	100.0	476.00
New York Power Authority	Indian Point 3	CO (1976)	965	100.0	965.00
	Fitzpatrick	CO (1975)	821	100.0	821.00
North Carolina Eastern Municipal Power Agency	Brunswick 1, 2	CO (1977, 1975)	1,580 *	18.33	289.61
	Shearon Harris 1	CP (1987)	900 *	16.17	145.53
North Carolina Municipal Power Agency #1	Catawba 2	CO (1986)	1,145 *	75.0	858.75
Eugene (OR) Water and Electric Board	Trojan	CO (1976)	1,130	30.0	339.00

Publicly Owned Utility System (By State)	Plant	Status 1/	Capacity (MWe) 2/	Public System's Share of Plant:	
				% Share	MWe Share
Piedmont Municipal Power Agency (SC)	Catawba 2	CO (1986)	1,145 *	25.0	286.25
South Carolina Public Service Authority (Santee Cooper)	Summer 1	CO (1984)	885	33.3	295.00
Austin (TX) Electric Utilities	South Texas 1, 2	CP (1987, 1989)	2,500	16.0	400.00
San Antonio (TX) Public Service Board	South Texas 1, 2	CP (1987, 1989)	2,500	28.0	700.00
Texas Municipal Power Agency	Comanche Peak 1, 2	CP (1989, 1990)	2,300	6.2	142.60
Burlington (VT) Electric Department	Millstone 3	CO (1986)	1,150	0.0435	.50
Lyndonville (VT) Electric Department	Millstone 3	CO (1986)	1,150	0.05	.58
Washington Public Power Supply System	Hanford Generating Project	CO (1966)	860	50.0	430.00
	WPPSS 1	CP (indefinitely delayed)	1,250	100.0	1,250.00
	WPPSS 2	CO (1984)	1,100	100.0	1,100.00
	WPPSS 3	CP (indefinitely delayed)	1,240	70.0	868.00
TOTAL LOCAL AND STATE PUBLIC POWER SYSTEMS			32,556	**40.4**	**13,137.20**

Publicly Owned Utility System (By State)	Plant	Status 1/	Capacity (MWe) 2/	Public System's Share of Plant: % Share	MWe Share
B. FEDERAL PUBLIC POWER SYSTEMS					
Tennessee Valley Authority	Browns Ferry 1-3	CO (1974, 1975, 1977)	3,195	100.0	3,195.00
	Sequoyah 1, 2	CO (1981, 1982)	2,296	100.0	2,296.00
	Watts Bar 1, 2	CP (date pending, 1989)	2,340	100.0	2,340.00
	Bellefonte 1, 2	CP (1994, 1996)	2,426	100.0	2,426.00
TOTAL FEDERAL PUBLIC POWER SYSTEMS			**10,257**	**100.0**	**10,257.00**
TOTAL LOCAL, STATE, AND FEDERAL PUBLIC POWER SYSTEMS			42,813	54.6	23,394.20

1/ STATUS: CP (date) - Construction permit (Projected date of commercial operation)
CO (date) - Commercial operation (Date unit available for regular production of electricity)

2/ CAPACITY (MWe): Figure, unless noted, is the design electrical rating (net), defined by the Nuclear Regulatory Commission as the "nominal net electrical output of the unit." All capacity figures were provided by public power systems with nuclear interests.

An asterisk (*) indicates a measured maximum dependable capability (net) rating, described by the NRC as "dependable main-unit gross capacity, winter or summer, whichever is smaller, less the normal station service loads."

A double asterisk (**) denotes a highest seasonal net capability rating.

3/ Participation sales contract for the life of the plant license; no plant ownership.

WRITTEN TESTIMONY

SUBMITTED APRIIL 28, 1987 TO THE
COMMITTEE ON ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE

CONCERNING
TECHNICAL AND ECONOMIC ISSUES IN THE
DEPARTMENT OF ENERGY'S
CIVILIAN NUCLEAR WASTE PROGRAM

BY

CLEVE R. ANDERSON, CONSULTANT
NUCLEAR WASTE MANAGEMENT
1065 EAST FLAMINGO #1001
LAS VEGAS, NV. 89119

The Nuclear Waste Policy Act of 1982 was enacted to facilitate the permanent disposal of high-level radioactive nuclear waste, HLW. The Department of Energy has been assigned responsibility to implement the program and is proceeding with its spent fuel burial plan.

In England, France, Germany, and Japan, they have determined that it is economic to recover and recycle the plutonium and uranium contained within spent fuel instead of burying it. They do this as soon as technically feasible or within a matter of months following reactor discharge.

By contrast, it has been stated by several witnesses appearing before Congressional Committees that it is not economic to recover and recycle plutonium and uranium in the United States. However, no cost studies to support such views can be found in either the Department of Energy document room or in the Library of Congress records.

Such an economic evaluation of plutonium and uranium recovery is needed for the domestic program before the Department of Energy's burial plan becomes immutable.

It is recommended that the Senate appoint an independent ad hoc committee to determine the safety and true costs of the following three approaches to HLW disposal:

1. The current DOE spent fuel burial plan.
2. Recovery and recycle of plutonium and uranium into light water power reactors by the process commonly identified as reprocessing. Such an approach would parallel that practiced by the French and British.
3. Recovery and recycle of plutonium and uranium as refuel for light water reactors after the spent fuel has first been allowed to cool for a) five years, b) ten years, and c) thirty years.

Preliminary cost studies indicate that the third approach will result in savings of thirty billion dollars over the current spent fuel burial plan of DOE. Plan three also has the advantage over approach two, reprocessing, in that the timing of plutonium-uranium recovery/recycle can be integrated with the future economic availability of domestic uranium ore.

Should the Senate appoint the recommended ad hoc committee, today, to study the above three alternatives for HLW disposal, the study results could be available within six months and at a cost of less than one-half million dollars. Thank you for the opportunity to present this written testimony as part of your hearing record.

TESTIMONY OF
NED R. MCWHERTER
GOVERNOR OF TENNESSEE

Presented to the

Senate Committee on Energy and Natural Resources

Washington, DC

April 29, 1987

Two years ago this month Tennesseans were introduced to an issue that has since dominated the attention of scientists, policymakers and those citizens concerned about the environmental quality of their state and community. The proposal by the Department of Energy to construct a Monitored Retrievable Storage facility in Tennessee has resulted in the most important and emotional debate of our generation.

This testimony is a brief attempt to express the concerns of the people of Tennessee about hosting an MRS facility. There is no pretense of examining in detail the complex financial, technological and environmental questions now before the Congress. The Congress will provide this forum for the nation's scientific community.

The testimony seeks only to underscore two points. First, when the MRS proposal was initially presented to the people of Tennessee in 1985, several concerns were raised about the project's feasibility. These concerns focused upon unanswered questions regarding the safety, cost and technology associated with the construction and operation of an MRS facility in Tennessee. After subsequent studies conducted both by Tennesseans and by others impartial to the results, those unanswered questions remain.

THE FEASIBILITY OF THE MRS PROPOSAL

Much of the debate regarding the MRS proposal has focused upon the desired location of the facility. To some extent, the emotional atmosphere in which this debate has occurred has distracted attention from the more important question of whether the MRS is needed to ensure the success of the nuclear waste program. Studies undertaken in Tennessee and by the General Accounting Office in Washington raise serious doubts regarding the financial viability of the MRS.

The Tennessee studies indicate that the rod consolidation and storage functions proposed for the MRS can be accomplished effectively at the individual reactor sites. The DOE could encourage this alternative with two initiatives. The first would provide utilities with credits for fuel consolidation. The second would make available to utilities duel purpose casks suitable for storage at the reactors and adaptable for later transportation directly to the permanent geological repository.

The case for pursing an alternative for on-site storage is strengthened by independent projections of the amount of spent fuel which nuclear utilities will generate. In fact, DOE recently adopted a number of the waste projection assumptions which the Tennessee study team used in 1985. Two years ago, DOE projections for spent fuel for the year 2000 were 20% higher than the Tennessee study. Today, the difference is only 2 percent.

As waste volume projections drop, so do claims of avoided reactor storage costs attributable to MRS. DOE has testified that these savings would amount to $150 to $450 million assuming the first repository was developed on time. These anticipated savings, however, were based upon earlier waste volume projections that have since been discounted. The Congress should be aware that the actual cost savings likely will not exceed $100 million.

Substantially lower projections for spent fuel represent an extremely important issue in the debate over whether there exists a "crisis" of accumulated nuclear waste at our reactors. A number of reactors probably will decide to consolidate fuel rods at their sites to conserve available storage space. For some this decision will come before the first repository will be available to accept spent fuel. This is an alternative which the Congress should examine thoroughly.

In recent years utilities and private support companies have been developing technology to consolidate fuel rods under water in the reactor storage pools. Some dry consolidation concepts also have been advanced, and several demonstrations have taken place. Others are planned by private firms anxious to demonstrate that the process can be done completed safely. When the consolidated fuel is placed back into exiting storage pools, unit costs will be lower than for MRS fuel handling.

For some reactors where further pool storage may not be appropriate, the fuel can be kept at the reactor site in dry storage casks. The technology for such casks is gradually maturing. Such a cask already is licensed for use in West Germany. American utilities and the NRC are moving toward general licensing of dry storage casks at reactors without additional site-specific approvals.

Taken together, the advancing technologies in reactor storage and diminished projections for the volume of spent fuel suggest strongly that the primary functions for which MRS was conceived might well be handled routinely at reactors by the time an MRS becomes operational. The motivation for such a policy would be nothing more than sound management by the utilities. With these options available to the utilities, the need for a temporary waste repository is no longer justifiable on grounds of cost or safety.

The task now should be to reinforce and reward the steps which have been made toward sound management of America's nuclear waste. DOE could begin by developing a credit system for consolidated fuel. Such a system of credits would recognize the benefits to the waste management system that result from the use of fewer casks and fewer shipments through the states. With this incentive, technology refinement for at-reactor consolidation could be moved forward at a quicker pace in response to DOE's efforts to organize and fund demonstrations.

DOE should accompany these efforts with a closer examination of cask designs that could serve both reactor storage and transportation functions. Such casks would reduce fuel handling and worker exposure. An appropriate prototype or duel purpose casks should be standardized by DOE for competitive manufacture.

MRS COSTS

Determining the cost of MRS to the Congress and to Tennessee has been extremely difficult. Costs estimates climbed from $2.0 billion to $2.6 billion between December 1985 and April 1986. As the General Accounting Office has revealed, even the latter figure did not include a lengthy list of expensive items. One such item, likely compensation to the impacted state and community, could easily reach $1 billion.

Apart from costs associated with the MRS construction, operating cost estimates contained in the proposal recently sent to Congress have been reduced dramatically, and warrant critical examination. Based upon highly questionable assumptions, estimates of total system life cycle cost increases due to MRS have been reduced from $2.6 to $1.6 billion. The billion dollar reduction received insufficient documentation in the proposal, was not explained prior to the proposal being sent to Congress and should therefore be highly suspect.

The projected economic benefits appear to fall far short of justifying the enormous cost of the MRS. The most favorable scenario of benefits, which includes a repository in Washington, would produce only $650 million. Benefits ratios for all other scenarios are far lower. The question before the Congress is whether $3 billion should be appropriated for an MRS proposal of dubious economic benefit. An issue of this magnitude should be resolved on the basis of sound data that is not subject to whims of arbitrary change.

THE INTENT OF THE NUCLEAR WASTE POLICY ACT

In addition to the cost and technological feasibility of the MRS proposal, the debate should include an assessment of the intent of the Nuclear Waste Policy Act. The past two years have been characterized by a sense of urgency regarding the development of an MRS. DOE's insistance in late 1985 that the proposal be acted upon immediately by the Congress is evidence of this generated sense of urgency. The MRS proposal was expedited despite requests by Tennessee officials for adequate time to allow citizens and the state review team to study the proposal adequately and develop comprehensive comments. Only litigation initiated by the state's Attorney General slowed the process temporarily. Yet a year after the litigation, the state's questions and concerns remain.

Other recent actions have served to undermine the intent and credibility of the Nuclear Waste Policy Act. The proposed five-year "extension" of the date for a first repository, and the proposed "postponement" of site-specific work on a second repository have created unwarranted pressure to proceed quickly with the MRS project. Recent emphasis on an unauthorized MRS and the proposed schedule "extension" to develop the authorized portions of the system constitute a distortion of the intent of the Nuclear Waste Policy Act.

A final effort to circumvent the intent of the Act is found in Senate 839. This bill would authorize an MRS and remove the protections for the host state that were wisely included in the original Nuclear Waste Policy Act. Enactment by the Congress of this legislation would contradict the spirit of the present law and serve to destroy the last remnants of trust between DOE and the states.

A long-term solution for nuclear waste is an issue of the highest priority. The Congress recognized this when it enacted the Nuclear Waste Policy Act. The fundamental principle was then, and still should be, that solutions for the problem should not be deferred to another generation. At issue today is whether the proposal to store nuclear waste in a surface facility would serve only to delay final isolation of the waste from the human environment.

CONCLUSION

This testimony has attempted to illustrate briefly what Tennessee believes to be seriously flawed assumptions contained in the MRS proposal now before Congress. The shortcomings of the proposal are not limited to practical considerations such as safety, cost and technological feasibility. They also include issues that reach to the heart of the relationship between the states and the federal government.

The Congress should bear in mind that Tennessee will be a temporary repository for nuclear waste even if the MRS proposal is rejected. The people of Tennessee are prepared to accept their share of responsibility for the spent fuel produced at the state's two nuclear plants. What they cannot justify is the construction of a facility in Tennessee designed to process nuclear waste from the entire country. They are unconvinced that the proposed MRS facility is either economically or environmentally sound. Moreover, they do not believe that the process of designing and locating the facility has been conducted in good faith.

Given the volatile history of this issue, it would be impossible in the current atmosphere of mistrust for any state to agree to host an MRS facility. There is a range of reasons to justify such opposition, some of which have been noted in this testimony. Surpassing all other considerations, however, is the fact that no site has been selected by the Congress as a final repository for the nation's nuclear waste. This failure to locate a final repository has occurred despite extraordinary efforts to construct such a facility in a number of western states. The absence of a final repository leaves an implication obvious to the scientist and the citizen alike. The MRS, rather that being the temporary facility to package spent fuel, will in fact become a permanont above ground repository for the most dangerous substance known to mankind.

On behalf of the people of Tennessee, I implore the Congress to heed the concerns expressed in this and other testimony. This issue will be among the most important addressed by Congress during the remainder of this century. The impact of the decision upon the lives of the people whom I serve will be profound and irrevocable. In the name of reason, and in the name of fairness, I urge that you not make this decision indifferently.

Senate Energy and Natural Resources Committee

THE MRS PROPOSAL OF THE DEPARTMENT OF ENERGY

Testimony of Ken Yager, County Executive,
and Robert Peelle, County Commissioner
Roane County, Tennessee
April 29, 1987

Introduction:

Distinguished Committee, staff, and fellow guests, I am Ken Yager, the elected County Executive of Roane County Tennessee. The Roane County portion of the City of Oak Ridge contains the preferred site and one alternative site selected by the Department of Energy (DOE) for its submission to the Congress for authority to build a Monitored Retrievable Storage (MRS) facility. Roane County includes only about 10% of Oak Ridge's citizens, but tens of thousands of acres of the Oak Ridge reservation.

Roane County has not taken positions on whether an MRS should be built or on the site selection process. This testimony relates to our needs in case the Congress decides to authorize an MRS in Roane County.

Roane County and the City of Oak Ridge together appointed the Clinch River MRS Task Force (MRSTF) to study DOE's plans to build a local MRS. When the work of the MRSTF was completed in 1985, Roane County stated that the proposed MRS "...could be acceptable to Roane County and provide a net economic benefit to our citizens if conditions equivalent to those in the Task Force Report are securely satisfied by the authorizing legislation and intergovernmental agreements provided for by that legislation." This position, taken in October, 1985, indicates that the county believed the MRS presented to us by DOE **could be** operated safely with adoption of our safety-related conditions. The State of Tennessee was quite supportive of our study of the MRS plans.

The DOE's proposal now before the Congress makes a real effort to deal with the concerns expressed by the Clinch River MRS Task Force (MRSTF). However, there remain substantial differences between our suggested remedies and those proposed by the DOE. Roane County and the City of Oak Ridge are now preparing to reconvene the MRSTF to review whether the DOE proposal satisfies local concerns and, if not, what additional remedies must be obtained. Since much has happened elsewhere concerning permanent repository arrangements since the MRSTF was active, new priorities may emerge. However, based on past MRSTF work, we already know several issues that require the attention of Congress. We believe these points would apply no matter where an MRS might be sited.

This testimony deals with the needs for (1) assuring that MRS storage is temporary, (2) building public trust that the facility will be operated safely over its lifetime regardless of unanticipated future changes in knowledge, policies, and implementation, (3) assuring that the DOE has the authority and responsibility to carry out the ideas in its proposal to Congress that relate to the local community, (4) revising the timetable for the Consultation and Cooperation Agreements relative to that for state "veto" and Congressional authorization, to permit useful negotiation, (5) broadening DOE's compensation authority to help make an MRS acceptable to our neighbors outside Roane County, and (6) any authorization to specifically include the measures to protect the local areas. These needs can be met through amendments to the Nuclear Waste Policy Act of 1982 (NWPA), through appropriate language in any MRS authorizing legislation, or possibly through clear legislative history underlying an MRS authorization.

Assuring that spent fuel elements won't stay at the MRS forever:

From the time Tennesseans first heard of the MRS idea, many have feared that the spent fuel sent to the facility would never leave. The DOE claims no such plan, but even those who trust the present leaders think that a working MRS would remove the pressure to complete a permanent repository. It is feared that the plan will one day be changed to enlarge the MRS and make storage permanent. The MRSTF proposed several measures to assure that fuel would be moved along to a repository according to plan. To gain acceptance of an MRS, we still believe several controls are needed: (the first two are included in DOE's proposal)

a) Limited storage capacity of 15,000 MTU.

b) No MRS operation until a permanent repository is licensed.

c) No more than 10,000 MTU shipped to an MRS until a permanent repository begins to accept shipments from it. (DOE now projects 6,000 MTU)

d) A large contractual annual "overdue removal penalty" should be paid to the state for any fuel rods that remain at the MRS longer than some fixed time, say 15 years.

Given the additional public concerns generated by the proposed delay in the permanent repository, the inviolability of these conditions needs to be insured by special steps such as (1) requirement that they be established in binding contracts between the DOE and state or local governments, or (2) requirement that any change in the limits (a) through (c) be subject to the same procedure of Congressional action, optional state veto, and possible Congressional override that now applies to the authorization of the MRS itself. The nation must keep its promises to the area that accepts an MRS.

Building public trust by offering some local control:

Public trust of government institutions is low, and trust of DOE in our area has been damaged by revelations that emissions by the federal plants were not corrected quickly when standards were upgraded. This distrust extends to fears that an MRS that could be safe will not be operated that way throughout its lifetime. We have found that much of the local public does not believe that the independent licensing authority, the Nuclear Regulatory Commission, would provide much protection. While it is recognized that the Tennessee Department of Health will have some jurisdiction over an MRS, the public knows that intergovernmental conflict and inadequate funds have sometimes prevented this department from being fully effective in the past. We know of no single or sure way to build trust that an MRS will be safe for the public and its workers, but our best idea was to combat the helplessness felt by individual citizens by instituting a measure of local control over the facility.

The MRSTF suggested that an ongoing MRS Environment, Safety, and Health Review Board for the facility be appointed by local governments and the State of Tennessee. The Board would have full access to operational information, independent inspection and monitoring authority, and limited power to order that inbound spent fuel shipments cease if jointly pre-established operational standards are not being met. This mechanism would provide a way for new understanding of hazards or unforeseen developments to be accounted for, or temporarily irresponsible management to be corrected before severe damage is done. Since local citizens could influence appointments and would know some of the Board members, trust in safety would be increased. The current DOE proposal embodies some of these functions into a suggested MRS Steering Committee that would predominantly represent nonlocal stakeholders. It would have broader jurisdiction but less power in emergencies.

While we see merit in the Steering Committee concept and believe that formation of such a committee should be considered in any Consultation and Cooperation (C&C) Agreement between Tennessee and the DOE, we believe it would not replace the need for a locally based Review Board concentrating on health and safety issues near the site. Congress recognizes that public health and safety have higher priority in the public view than any other considerations; that priority should affect MRS institutional arrangements. While the membership of this Review Board should perhaps be drawn more widely from the surrounding counties than the MRSTF suggested, its membership should be dominated by persons from the local area who would suffer if the MRS should be operated unsafely. Formation and empowerment of such a Review Board should be mandated by the Congress because such institutions are unusual. Such a Board might be difficult for the DOE to accommodate without Congressional direction.

Giving DOE the authority and responsibility to implement its proposal:

The NWPA may not give clear legislative authority for some of the arrangements requested by Roane County and accepted in DOE's submission to the Congress. For example, clear authority should be given for grants equal to all taxes for the MRS, similar to the authority given for the permanent repositories. This issue is particularly sensitive in Roane County because of its long term difficulties in obtaining appropriate payments in lieu of taxes for the extensive local DOE research and production facilites.

The NWPA may not now permit the DOE to negotiate binding C&C agreements with local government units; indeed the DOE's proposal calls for achieving many of its commitments to Roane County through negotiations between the DOE and the State of Tennessee. While we anticipate that state officials will cooperate with us in meeting our needs, these officials will have other high priorities in such negotiations and might find it burdensome to be responsible for local issues as well. We would prefer direct arrangements and direct accountability in order to assure fulfillment of DOE's proposals relative to Roane County. Therefore, we request that formal authority be given to DOE to negotiate binding C&C agreements on local issues directly with local government units.

Revising the timetable for interactions with state and local governments:

The NWPA includes innovative processes for negotiation of C&C Agreements with the states, and also for consideration of state "veto" notices. Both these processes are appropriate, but Roane County is concerned that the timetables for these actions may in practice interfere with their execution. Roane County suggests that the Congress reconsider this matter if an MRS is to be authorized. We suggest as a possibility that any notice of disapproval be submitted six months after authorizing legislation, to give a chance for negotiation of C&C agreements that might make a notice of disapproval unnecessary. In this regard, we caution that any process that appears to be coercive to state or local government in areas of public health or safety would be counterproductive to succesful siting.

Meeting the concerns of neighboring areas outside Roane County:

While the MRSTF confined itself to the needs of Roane County and the City of Oak Ridge if an MRS were sited there, we are sensitive to the needs of the immediately surrounding areas. An MRS in our area might produce a stigma that would negatively affect the economy of a broader region. (We can understand the thoughts of our neighbors if we project our own reactions to the possibility of the facility being sited for instance in neighboring Morgan County.) Except for covering direct costs of extra emergency services, etc., it is not clear how the DOE proposal would fully compensate any such stigma. If standard licensing steps and measures like the proposed Public Health and Safety Review Board and public monitoring programs satisfy area concerns about safety, additional measures should be available to compensate the surrounding area for the potential costs of the stigma associated with nuclear waste.

A good feature of the compensation arrangements of S-839, the Nuclear Waste Policy Act Amendments of 1987, is that funds would be available through the state to provide this compensation. However, host area residents must first be convinced that the issue of future safety has been resolved. Then, the question of compensation for important but unquantifiable impacts like "waste stigma" can be considered without a connotation of "bribery" that would be counterproductive to siting.

Making sure that any MRS authorization mitigates local concerns:

Roane County requests that no matter what route the Congress uses to authorize an MRS, it be specific that the measures proposed by DOE to mitigate local concerns be included along with the additional points identified in this testimony.

Conclusion:

Roane County believes that the requests it has made in concert with the City of Oak Ridge are reasonable as well as demanding. In the current climate, measures are required that would not have been expected a decade ago. Should an MRS be authorized elsewhere, we believe that the local communities will have similar concerns that will require the same legislative remedies.

We ask that the mitigation and compensation measures provided for by the Congress include the most important proposed measures even if they seem unfamiliar or difficult. For example, the issue of limited local control over potentially noxious facilities is a strong one that will have to be addressed widely in the future. Note that a Pennsylvania study of several potential host communities for low level radwaste facilities also identified desire for local control as a major issue. (Richard J. Bord, Opinions of Pennsylvanians on Policy issues Related to Low Level Radioactive Waste Disposal, Pennsylvania State University, September 1985)

We thank you for your attention. We can provide more detailed information if it will be helpful to your deliberations.

Ken Yager
Roane County Courthouse
Kingston, TN 37763
(615) 376-5578

Robert Peelle
130 Oklahoma Avenue
Oak Ridge, TN 37830
(615) 483-8974

MORGAN COUNTY, TENNESSEE
A Sound and Scenic County
OFFICE OF
MORGAN COUNTY MRS STUDY GROUP
WARTBURG, TENNESSEE 37887

June 19, 1986

Mr. Bernard C. Rusche
Director Civilian Radioactive
Waste Management
Department of Energy Room 5-A085
Forrestal Building
1000 Independence Avenue, S. W.
Washington, D. C. 20585

Dear Mr. Rusche:

As co-chairmen of the Morgan County MRS study group, I am pleased to inform you that the Morgan County Executive Commission unanimously endorsed our report recommending the Monitored Retrievable Storage (MRS) facility being built and operated in Morgan County.

This past February, our County Executive, Tony A. Duncan, appointed a group of Morgan County residents to study the capability and desirability of locating the proposed MRS facility in Morgan County. After a comprehensive review of the previous reports and studies dealing with the potential safety, economic, and social impacts of an MRS facility being located in other areas of Tennessee, we reached the conclusion that if certain recommendations and provisions are met, the people of Morgan County would welcome this facility and would provide a congenial, continual stable, and cooperative partner in this vital operation. (The report containing this conclusion and the related recommendations and provisions is attached.) Upon approval by the Morgan County Commission and the two incorporated towns within the County, the report was transmitted to Governor Lamar Alexander for his agreement and support in our attempts to locate this facility in our County.

Mr. Rusche, in furtherance of our efforts, we are requesting your support in locating the MRS in Morgan County. We realize your department has spent significant time and manpower in an attempt to site the MRS. In so doing, your department chose Oak Ridge, Tennessee with first choice being the Clinch River Breeder Reactor site. We respect your efforts and recognize the advantages the site in Oak Ridge presents the Department of Energy. However, for some of the very same reasons, we believe that Morgan County should be the preferrable host for the MRS. We encourage you to review our report to better understand the unique benefits Morgan County offers for this facility.

Finally, Mr. Rusche, we would like to request a meeting in the near future with you and the members of our MRS study group in order for you to have a clean and thorough understanding of our position regarding the MRS. A trip to Washington can be easily arranged and we look forward to our meeting. Should you or your staff have any questions concerning our report or other issues involving the MRS in Morgan County, please feel free to call either of us at (615) (Duncan) 346-6288; (Freytag) 346-3101.

Yours very truly,

Tony A Duncan

Tony A. Duncan
CO-Chairman/Mrs Study Group

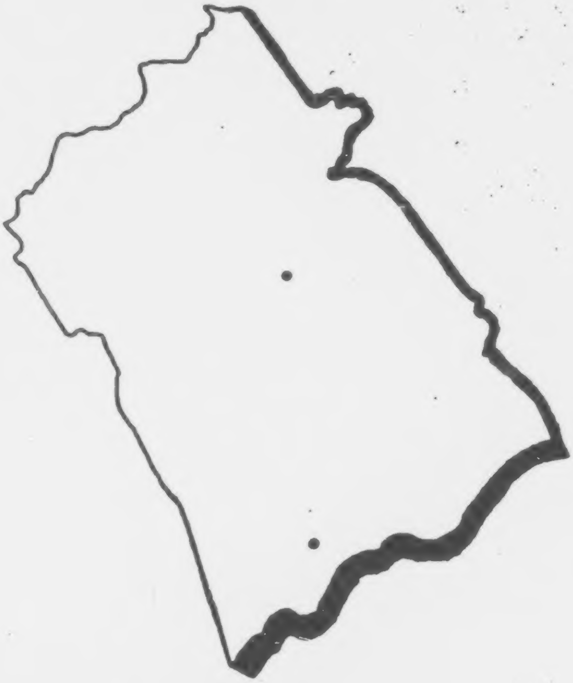
Floyd E Freytag

Floyd E. Freytag
CO-Chairman/Mrs Study Group

TAD: eed
FEF:
pc: Office File

MORGAN COUNTY

MRS TASK FORCE



Morgan County, Tennessee

MRS STUDY GROUP COMMITTEES

CO-CHAIRMEN:

Tony A. Duncan
Morgan County Executive

Floyd E. Freytag
President/Plateau Utility District

Jeanette Powers
Mayor of Oakdale

Rodney McPeters
Mayor of Wartburg

Roger B. Long
Morgan Co. Superintendent of Highways

Joe Judkins
Morgan County Attorney

Dr. Clayton Weaver
Oak Ridge Accociated University

John Galloway
Administrator/Morgan Co. Health Council

Fred Roettger
Engineer, Martin Marietta

Stone Hennessee
Morgan Co. General Sessions Judge

Conrad Strand
Chairman, Abner Ross Community Center

Dudley Freels
Morgan County Assessor of Property

Roy McNeal
Wartburg City Councilman

Allan Nance
Morgan Co. Superintendent of Schools

Royce Cross
President, Morgan Co. Education Assoc.

Guy Underwood
Local Businessman

SAFETY COMMITTEE:

Dr. Clayton Weaver, Same as above
Guy Underwood "
Lester Heidel, Technician Martin Marietta
Tom White, Emp. TVA Nuclear Plant

SITE COMMITTEE:

Roger B. Long, Same as above
Conrad Strand, "
Mike Hall, Student Roane State C.C.
Ron Lee, TVA Safety Department

PUBLIC ACCEPTANCE:

Jeanette Powers, Mayor of Oakdale
Wanda Smith, Local Businesswoman
Rodney McPeters, Mayor of Wartburg

MORGAN COUNTY MRS STUDY GROUP
FEASIBILITY AND DESIRABILITY
OF
MONITORED RETRIEVABLE STORAGE SYSTEM
LOCATING IN
MORGAN COUNTY, TENNESSEE

On February 19, 1986, Morgan County Executive, Tony Duncan, appointed a group of Morgan County residents to study the capability and desirability of locating the proposed Monitored Retrievable Storage Facility in Morgan County.

It was originally proposed that this facility be located in the Oak Ridge-Roane County area; however, strong oppositions to its placement there surfaced. It was perceived that this facility would do immeasurable harm to the future development of the Oak Ridge-Knoxville area by, causing prospective industry which the Oak Ridge-Knoxville area is imminently qualified to service, to bypass, or to avoid the Oak Ridge-Knoxville area. It was pointed out that the state is investing hundreds of millions of new dollars in the technology corridor from the Knoxville airport to the Oak Ridge National Laboratory, for a new technical institute, a science alliance, an interstate quality highway, and an improved University of Tennessee. It was thought that the placement of the MRS storage facility adjacent to this corridor would seriously erode and damage its image as a technological center.

These concerns are well founded and are supported by industry surveys which indicate the majority of the more desirable industries would avoid or hesitate coming to the Oak Ridge-Knoxville area if the MRS facility was also located there. There is every indication, that in the final analysis, the Oak Ridge-Knoxville area would lose many more jobs, payrolls, and trade advantages than gained from the temporary advantages of the MRS facility.

The objections to placing the MRS facility in the Roane County part of Oak Ridge do not exist or apply to Morgan County, beacuse the Morgan County area is not desirable to the same kind of industry that would possibly locate in the Oak Ridge area. Therefore, it has been suggested that serious consideration be given to placing this facility in adjoining Morgan County. For this reason, the Morgan County study group was implemented.

This group has conducted an investigation and study to ascertain if it would be desirable or provide any economical value to have the MRS facility locate in Morgan County. The study group also wanted to know the impact an installation of this kind would have on the Morgan County area. Could this facility be constructed and operated with reasonable safety, and would it be acceptable to the people of Morgan County, and on what terms? All of these questions have been addressed, and the groups findings and conclusions are explored on the ensuing pages of this report.

The Nuclear Waste Policy Act of 1982 requires the Department of Energy (D.O.E.) to provide for the development of Deep Geological repositories for the disposal of spent nuclear fuel and other high level radioactive waste, and to submit for Congress's consideration, a proposal on the need for one or more Monitored Retrievable Storage facilities. Although initially, the M.R.S. was considered as a backup for a repository, D.O.E. determined that the facility would perform a more effective role as a receiving, packaging, and temporary storage for fuel assemblies enroute to a permanent repository.

In April of 1985, the D.O.E. announced that three (3) Tennessee sites were under consideration for the proposed Monitored Retrievable Storage facility. Shortly afterwards, Governor Lamar Alexander initiated a review of the proposal. This review was to be coordinated by his Safe Growth team, as the primary and secondary sites suggested, and seemingly favored by the Department of Energy when located in Tennessee, with two of them located in the Oak Ridge part of Roane County. These three localities were invited to participate in the state's review of the M.R.S. proposal. To activate their participation in the review, the Clinch River M.R.S. Task force was devised, and was subsequently given a $100,000.00 grant to defray their expenses.

At this time, no one was aware of the potential sites a short distance away in the adjoining Morgan County. Therefore, the desirability of placing this facility in Morgan County was not explored. Later various business and industrial surveys were made that revealed the potential damage the location of this facility in the Oak Ridge-Roane County area could do to the future development of the Oak Ridge-Knoxville area. Morgan County was then considered as a possible site.

The negative views and mis-givings expressed by valuable and important industrial people toward locating a MRS facility in the Oak-Ridge-Knoxville area alarmed Governor Lamar Alexander and members of the business community of the Oak Ridge-Knoxville area. It was during this time that officials and public-minded citizens of Morgan County were invited to study the possibility of locating this facility in Morgan County.

One of the problems addressed by the Morgan County M.R.S. study group was the desire of all participating agencies to get this project underway. We were advised by a D.O.E. official that a change in location to a Morgan County site would require them to make a new site study and evaluation that could delay this project as much as six months.

According to the Department of Energy, construction of this project has not been scheduled to begin until July 1991 and would go into pilot operation on December 1995, and full operation, October 1996.

According to this schedule, a beginning of plant construction is approximately five years away. We assume this interim would be used to complete plans and designs for this facility. We see no reason why the planning and designing of this facility could not be carried on simultaneously with the site and study evaluation which would permit them to maintain their original schedule.

One of the group's most serious concerns throughout this study has been, "Can this facility be operated with reasonable safety?" This group has not, themselves, conducted any test or in-depth study as to the safe construction and operation of the MRS plant. We have, however, made a diligent search for information pertaining to the safety, both during construction and follow-up operations. We have tapped many qualified sources in the state, and have relied heavily on studies and tests conducted by other very reliable groups that have the facilities, competent personnel, and finances to make the extensive tests and studies necessary to evaluate the safety of this operations.

We have carefully reviewed information, studies, and tests assembled by the Clinch River MRS Task Force, the Tennessee Department of Health and Environment, the Department of Energy of the United States, and the Sandia National Laboratories. The Tennessee Department of Health and Environment and the United States Department of Energy have been especially cooperative and generous of their time and facilties.

We were especially interested in the recommendations prepared by the Clinch River MRS task force.

We made an exhaustive review and study of this document and were tremendously impressed by this group's study of every phase of this facility having to do with safety. We were unable to find any areas that had not been covered, explored, analyzed, and evaluated in a very efficient and business like manner. The entire study by the Clinch River MRS task force was made with the assumption that this facility would be located in the Oak Ridge part of Roane County; however, we find that their conclusions pertaining to safety were equally applicable to the proposed sites available in adjoining Morgan County. Their final conclusion was that this facility could be operated with safety.

Based upon all the information we have acquired to date, the Morgan County Study Group concurs with the finding of the Tennessee Department of Health and Environment, the United States Department of Energy, and the Clinch River MRS Task Force that this facility can be constructed and operated safely without serious environmental damage or hazard to health.

Indications are that area residents believe that this facility can be constructed and operated safely in Morgan County. However, at the same time, they exhibit skepticism that this facility will actually be constructed and operated in a safe manner.

The Clinch River M.R.S. Task Force has addressed this concern and has made numerous suggestions regarding safeguards. Rules and regulations, if adopted by the D.O.E. and practiced in the operation of this facility would not only allay the public concern, but would improve the Nuclear industry and Department of Energy's public image.

The Morgan County MRS Study Group endorses and concurs in all the safety rules, conditions, and recommendations made by the Clinch River MRS Task Force and incorporates all of them into our study and makes them part of our report. But with the further stipulation that if the facility comes to Morgan County, all the safety features recommended by the Clinch River Task Force that can be adapted to the Morgan County site, become a part of the terms for acceptance of this facility.

To further allay the public's concern and to improve the public perception of the Nuclear Industry and the Department of Energy as a whole, and to allay any apprehension local citizens may have, we would emphasize the importance of creating a "Citizen's MRS Environment, Safety, and Health Review Board" consisting of 7 members. This board would represent the areas of interest during the construction, operation, a decommissioning of the proposed MRS facility.

We would suggest that the membership of this board be composed of one person from each of the two incorporated towns selected by the city council; three persons from unincorporated areas selected by county commission; and two persons to be appointed by the State of Tennessee.

The membership of this Citizen's MRS Environment, Safety, Health Review Board would operated under normal arrangements with the responsible federal and state agencies. We would not supplant Regulatory Agencies responsible for the activities of the proposed MRS to the greatest extent possible. We would make use of data collected by these agencies; however, the board would have the authority to conduct its own inspection and collect additional data as needed.

The board should also participate in the environment, health, and safety performance standards and criteria by the MRS facility. Also, the board should have access to all information on the condition of shipments arriving at the MRS, effluents released to the outside environment; radiation to the exposed workers and to the surrounding population; and accidents and incidents as classified by the N.R.C.

Also, procedures should be developed whereby the board could suspend operations, if releases at the MRS are above action levels jointly pre-established by the Department of Energy and regulatory agencies.

Further, all information on radiation releases and accidents should be made available immediately to the proposed Citizen's MRS Environment, Health, and Safety Review Board, as well as to the general public.

We would further recommend that transportation safety be enhanced by means of strict inspection performed at the originating point of each spent fuel shipment, and again at the MRS facility. Shipments out of the MRS to the permanent repositories should be subject to identical inspections, and these inspections conducted by personnel independent of the Department of Energy, should guarantee compliance with rigid standards relating to radiological vehicles and personnel safety. Those conducting such inspections should have authority to detain non-complying outgoing shipments and levy stiff penalties for non-compliance with applicable standards.

As the NRC licensee by the MRS facility, the Department of Energy should assume the lead role in developing emergency response procedures to be followed by local and state personnel in the event of an accident involving spent nuclear fuel. First responders from local and state agencies should be trained and equipped by the federal government with associated costs including full operation funding born by the MRS nuclear waste fund.

We would further insist, to insure prompt planning, site selection, and construction of a permanent storage for nuclear waste that no more than 10,000 metric tons of spent fuel should be received before the outshipment of consolidated fuel rods begins to the permanent repository.

Any proposed extension of the MRS facility beyond the proposed 15,000 metric tons currently envisioned should be subject to the same review and notice of disapproval procedures followed to initially authorize the MRS.

Any spent fuel stored at the MRS longer than 15 years shall be subject to a significant overdue removal penalty levied by the state.

The Morgan County MRS Study Group is aware that this facility in Morgan County, or in any other location would encounter many possible problems; accessability of railroads, interstate route, density of population, would or could create problems.

The Morgan County MRS Study Group has defined and located 5 sites (Exhibit#1) in Morgan County which the group feels the Department of Energy should investigate. The 5 suggested sites are located on State owned property that is available as a site for this facility. The proposed Morgan County sites would probably incur less problems than sites outside the county but would not be entirely problem free.

The suggested Morgan County sites are located in the same general area and have the same general characteristics as the Clinch River Breeder Reactor site which the Department of Energy indicates has many qualities that are desired in the location of this facility.

All five of these sites were presented for evaluation and consideration to the Department of Energy and their selection was based upon criteria established by the D.O.E. Considerations were given to the following:

1. Geology of the area
2. Site relief in relation to topography
3. Access to rail facilities
4. Access to interstate highway system
5. Proximity to populated areas
6. Environmental settings
7. Geotechnical site characteristics

The site we feel is especially adaptable and suitable for the MRS plant location is the site which we list as Number 1, (Exhibit #2). It is located approximately 5.6 miles southwest of Wartburg, 3.88 miles to a Class IV railroad, and 11 miles to the I-40 interchange which has already been approved by the Tennessee Department of Trnasportation, and has been scheduled to be completed in 1989.

Access to the MRS to this site from I-40 and from I-40 to I-75 would require the construction of approximately 11 miles of roadway. This road would be, for the most part, through and over state owned land. It would be located in a very sparsely populated area and few, if any, families would be displaced by its construction and use.

Its use would be almost exclusively for the transportation of the nuclear fuel rods coming to the MRS facility.

Construction of approximately 4 miles of railroad, which should be equivalent to a Class IV railroad, would connect this facility with an existing Class IV railroad. This also would be through a sparsely populated area.

U.S. Highway 27, state route 20, is scheduled for improvement under the Tennessee Highway Improvement Act from Oneida south. The scheduled beginning of this project should be expedited with priorities given to the elimination of curves and the three-laning of hilly sections.

A new section of highway should be constructed linking Highway 27 at Wartburg to the MRS site and to the Rockwood interchange. This can be accomplished with a few miles of new construction linking Hwy 27 to the MRS site, and the access road to the interstate I-40 would be through a very sparsely populated area of State owned property. Few, if any, families would be displaced on this construction. This would give access from Northern areas to the MRS facility.

We would, also, recommend that Hwy. 62 from Wartburg to the intersection of State Route 289 and the section 289 to the 1-40 interchange of Crossville should be upgraded.

Costs for necessary improvements and new construction to state and local routes listed above, or in any other route improved for the purpose of transporting nuclear spent fuel rods to and from the MRS facility, should be born by the Federal government, or should be authorized as an expenditure by the MRS funds.

Morgan County is a rural county with a population of approximately 16,000 people. Morgan County has two incorporated towns, Wartburg and Oakdale. The majority of the population is located in the general vicinity of Wartburg which is the county seat. The county has a tax rate of $6.60 and a bonded indebtedness of approximately $13,000,000.00 with an assessed value of approximately $54,000,000.00. About 24% of our land area is owned by the State of Tennessee and approximately $3.00 of our tax rate is necessary to service the bonded indebtedness.

Unemployment is about 14% and mean income is small. At one time, timber and coal were our main industries. Both of these sources of income and employment no longer exist to any degree. Our sources of employment at the present time are a woven label plant, 2 garment plants, a transformer plant, and Pioneer industries. All of these are low paying industries and do not make as significant an impact on our economy as the MRS would.

Funds for the construction and maintenance of rural roads are inadequate; therefore, they are badly in need of improvements and maintenance. Four utilities are presently operating small water system, the largest being Plateau Utility District and service Wartburg with 1200+ connections. All of the utilities are in need of expansion and improvement.

We have a school population of about 3200. To provide facilities, utilities, structures, maintenance, and other educational material creates a special burden on a county with our limited tax base. The result is that our educational system is under-financed and our young people are trying to obtain an education in a substandard educational system.

We are confident that this MRS facility can be constructed and operated safely and would cause no undue harm or hazard to the health of the people of Morgan County.

We are also confident that any of the Morgan County sites we have suggested to the Department of Energy to examine are equal to, or superior over all, to any sites they have considered elsewhere. Also, we believe that this facility can be operated more economically in Morgan County than any other site, without secrificing any of the safety rules, regulations, and conditions set out in our study, or by the study of the Clinch River MRS Task Force.

Our investigation indicates that the people of Morgan County would welcome this facility into Morgan County if they perceived that it would be of economic value, or helpful in solving many of our problems.

In our efforts to determine if this MRS facility would be acceptable to the citizen's of Morgan County, we found its acceptance rested on three questions:

1. Could, and would, this facility be constructed and operated with reasonable safety?
2. Would its location in Morgan County be of any economic value to Morgan County?
3. What impact would its location in Morgan County have on our tax funded facilities, such as; schools, law enforcement, rural roads, utilities, including water, sewage, power, etc.?

We have already addressed the first question and our conclusion that this facility could be operated and constructed safely are stated in the forefront of this report. These conclusions are based upon the combined conclusions and reports between all agencies and groups we encountered in making this study, "That this facility could be constructed and operated safely".

The best information available to us indicated that something like 700 employees would be required during the construction phase of this project; and after construction, approximately 400 to 500 employees would be required to operate this facility.

We realize that due to our proximity to Anderson and Roane counties a large share of this employment would go to these two counties. Nevertheless, we are confident that substantial number of these jobs would come to citizens of Morgan County. To a county of a 14% unemployment rate, these jobs would be extremely valuable.

To insure our citizens receive a fair share of jobs generated by this facility, we would recommend that a training program be instituted in the Morgan County Vocational School for the purpose of training local citizens for job placement.

This program would operate under the supervision of the Department of Energy and would involve the following programs:

1. Health and safety monitoring
2. Remote handling system operation, safety, and maintenance
3. Communications operation, safety, and maintenance
4. Storage cask manufacturer
5. Transportation, cask service, and maintenance

The entire cost for this training program would be funded by the Department of Energy from MRS funds.

We are advised that the construction of the MRS facility, itself, would cost approximately one-billion dollars. Cost of on-site storage cask would eventually add another three-hundred-million dollars, and many additional millions from associated activities connected with the operation of this plant.

The release of the above dollars into this area would certainly have an impact, not only our economy, but would boost the economy of Anderson and Roane counties. Oak Ridge, in Anderson County, and Harriman and Rockwood in Roane County are trade centers for people of Morgan County; and naturally, many of these additional new dollars would find their way into Anderson and Roane counties.

After a careful examination of the likely impact a Monitored Retrievable Facility would have on Morgan County, we were able to identify a number of concerns or potential liabilites beyond our present capacity to handle without financial assistance.

Certainly a facility of this kind would increase activities on every level; and the natural increase demand upon our facilities, would strain them beyond their present capacity.

Every phase of public service furnished by local, county, and city government would need to be expanded and upgraded. To finance these projects on our limited tax base would create an impossible burden on local tax payers and this facility, instead of being a blessing, could become a disaster.

To make the location of the M.R.S. facility in Morgan County acceptable to Morgan County people, the following conditions would need to be acted on favorably.

In order to enable the D.O.E. to financially assist local governments, we would recommend that the MRS authorization include a section similar to Nuclear Waste Policy Section (116c) "to permit tax equivalency payment on real and person property, and other financial incentives to units of local government."

We would recommend a schedule of annual impact-assistance-payments to be made to state and local governments from authorization until operation; and from cessation of operation until full decommissioning and decontamination; such payments to be equal to the tax equivalent grants generated by a one-billion-dollar facility.

We would further recommend that during operation, the MRS facility would provide annual grants to local governments in amounts equivalent to all state and local taxes.

Due to Morgan County's limited tax base, the 13 million dollars bonded indebtedness outstanding against Morgan County now requires $3.00 of the total tax rate just to service this indebtedness. We would recommend that the Congress authorize the MRS facility to either liquidate or assume the payment of this indebtedness. This would reduce Morgan County's tax rate to slightly less than $4.00 dollars and would reduce, substantially, the impact assistance to be paid to Morgan County under these recommendations.

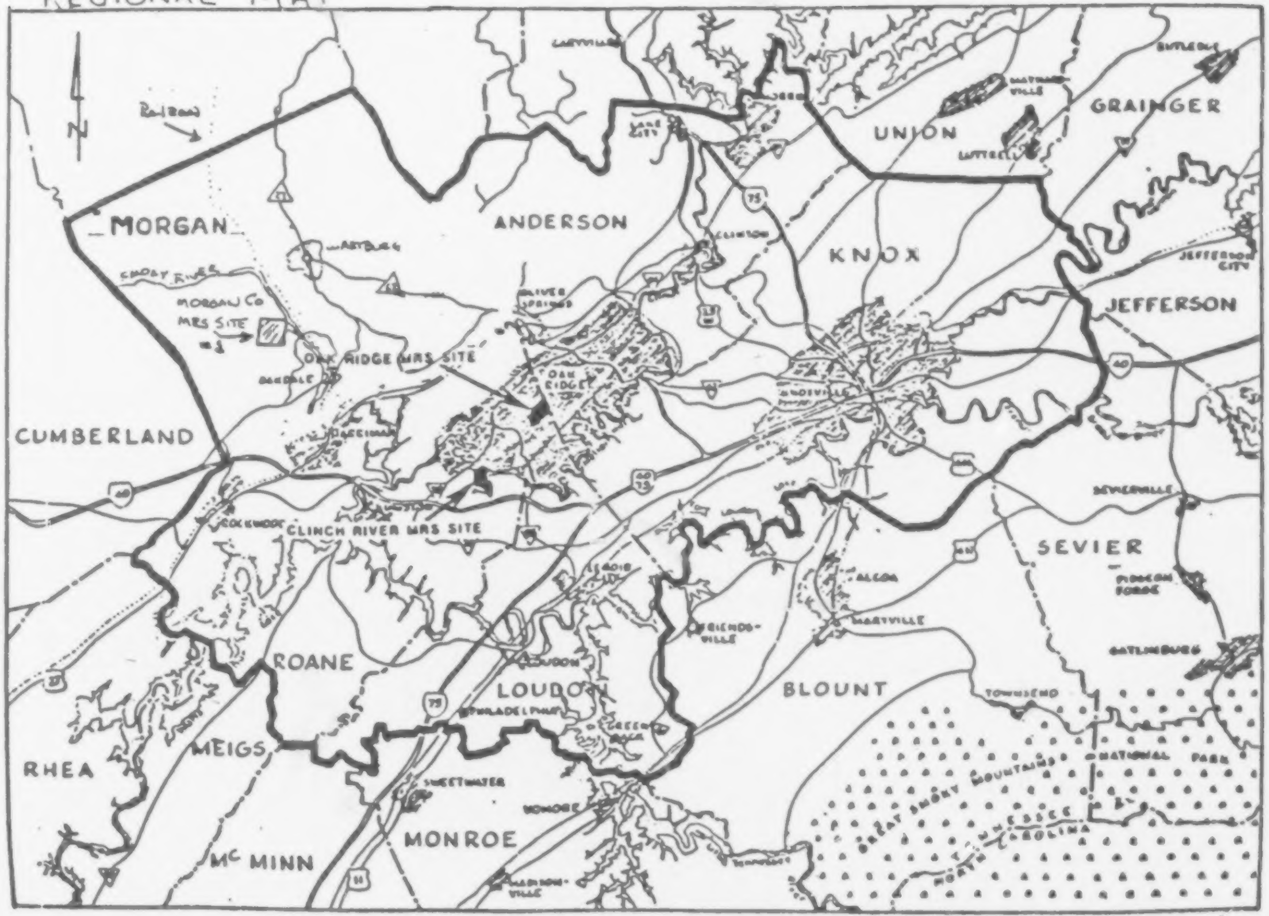
We would solicit a pledge to construct, staff, operate, and promote a MRS Visitor's Center in the vicinity of the MRS facility for the purpose of explaining MRS and its role in the integrated nuclear fuel cycle, and to esthetically design and landscape the entire MRS complex.

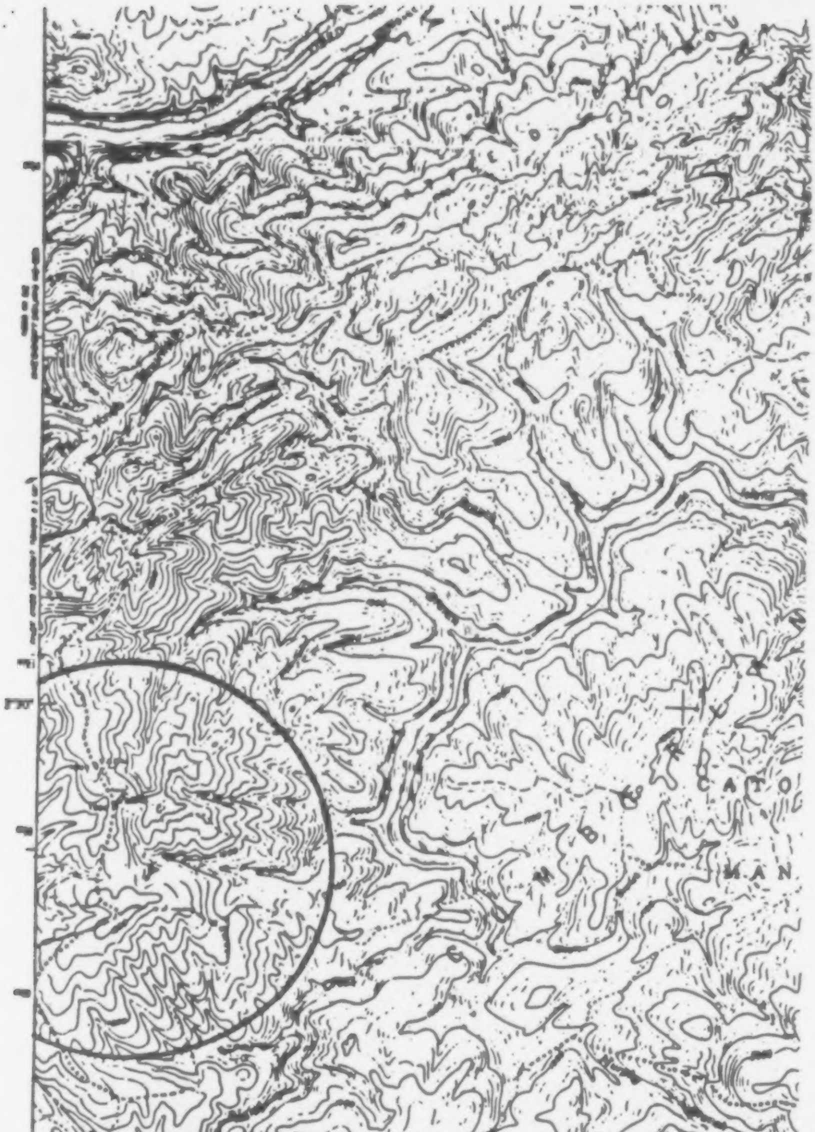
We recommend that MRS provide a decommissioning and decontamination immediately upon completion of MRS's mission in such a manner as to restore the MRS site to unrestricted use.

The location of this facility in Morgan County, as in in any other county, would create a strain and special burden financially on local facilities and utilities; such as law enforcement, schools, sewer and water systems, rural roads and feeder roads. We would recommend that the Department of Energy be authorized with Morgan County officials, including Oakdale and Wartburg city officials, and any utility districts that provide any of the above services to make a joint study to determine what financial assistance these facilities would need to enable them to meet present and additional responsibilities. Also, that the MRS be authorized to provide grants for the purpose of upgrading these facilities.

If these recommendations are met, the people of Morgan County would welcome this facility to Morgan County and would provide a congenial, continual, stable, and cooperative partner in this vital operation.

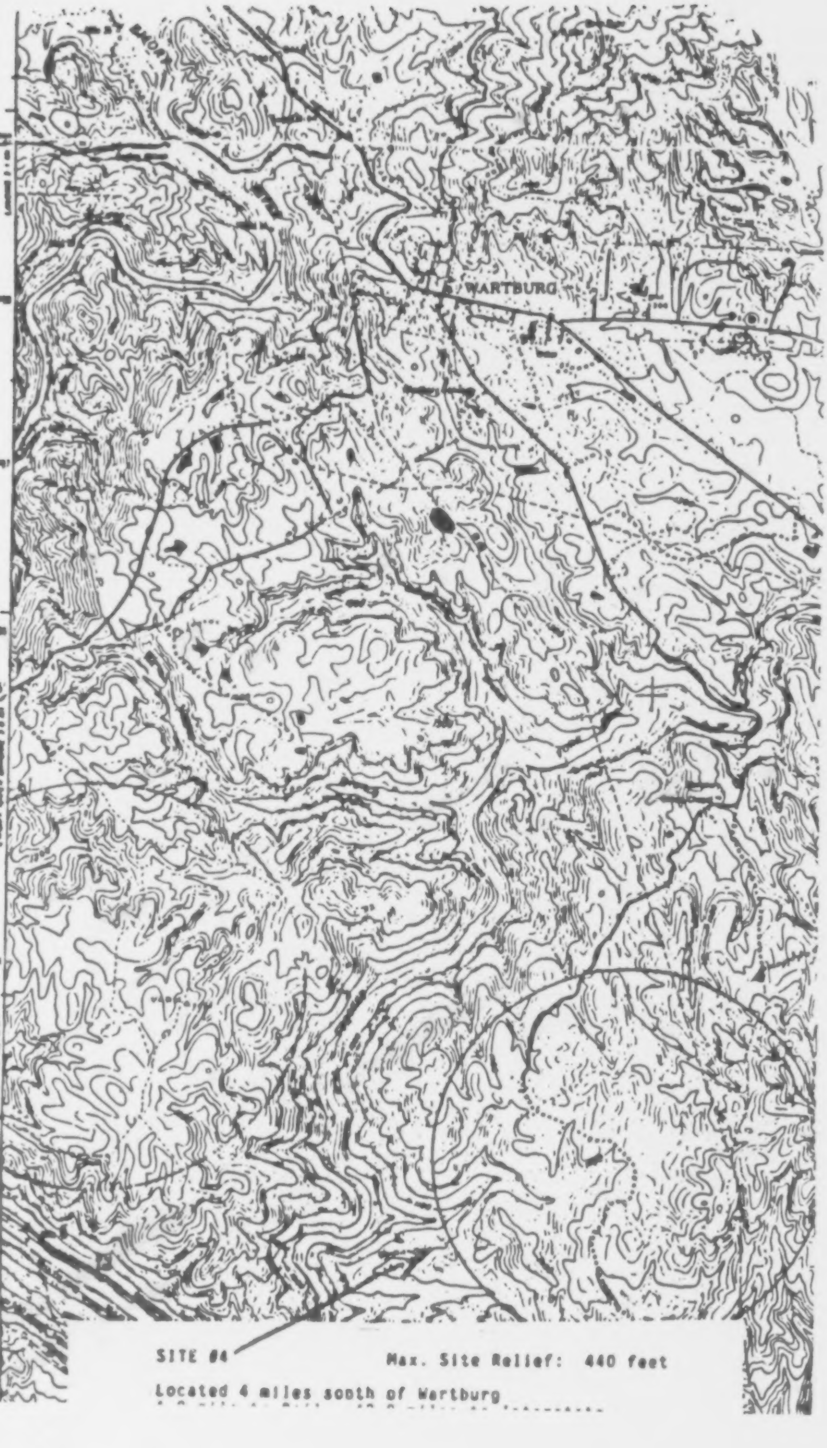
REGIONAL MAP





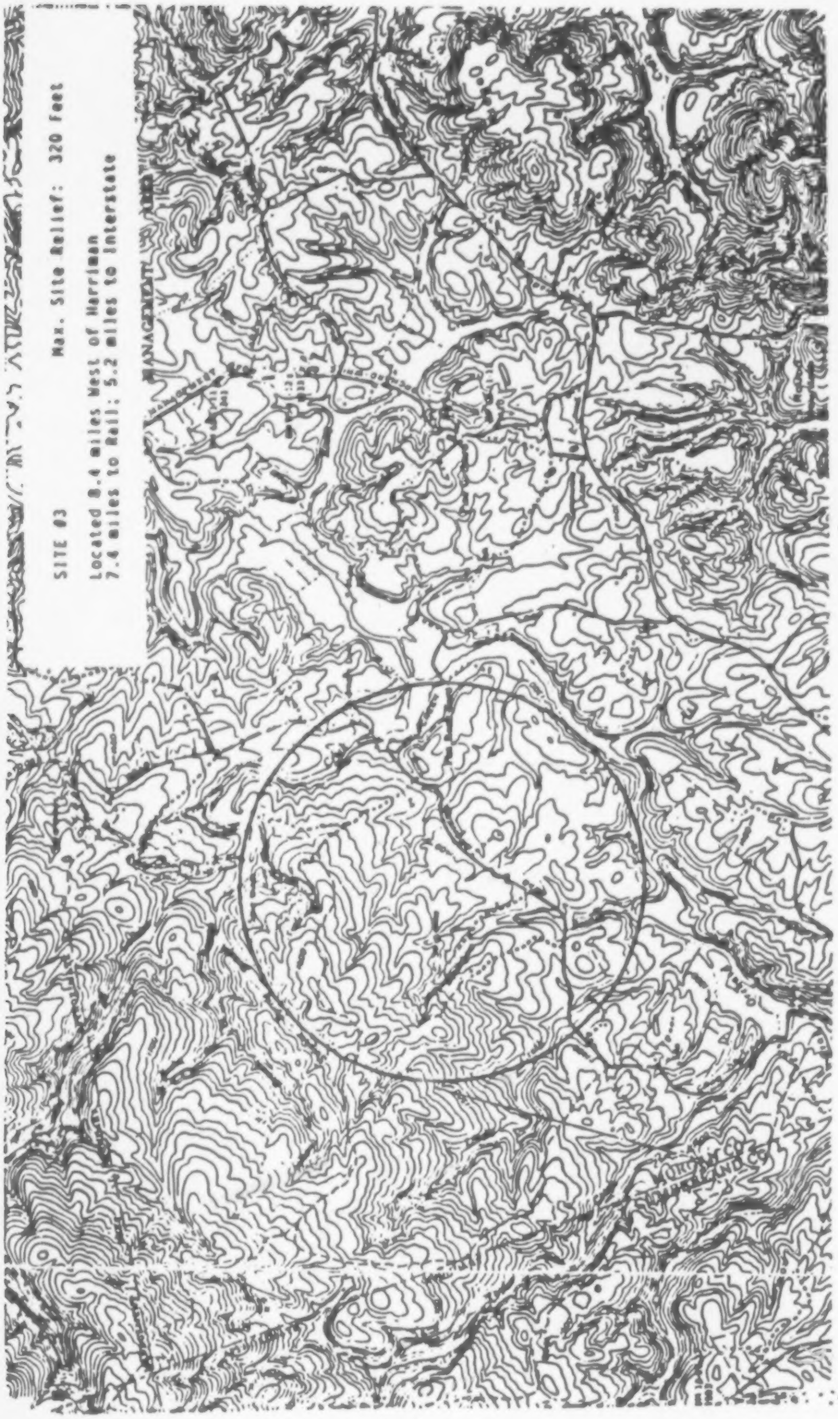
SITE #5   Max. Site Relief: 200 feet

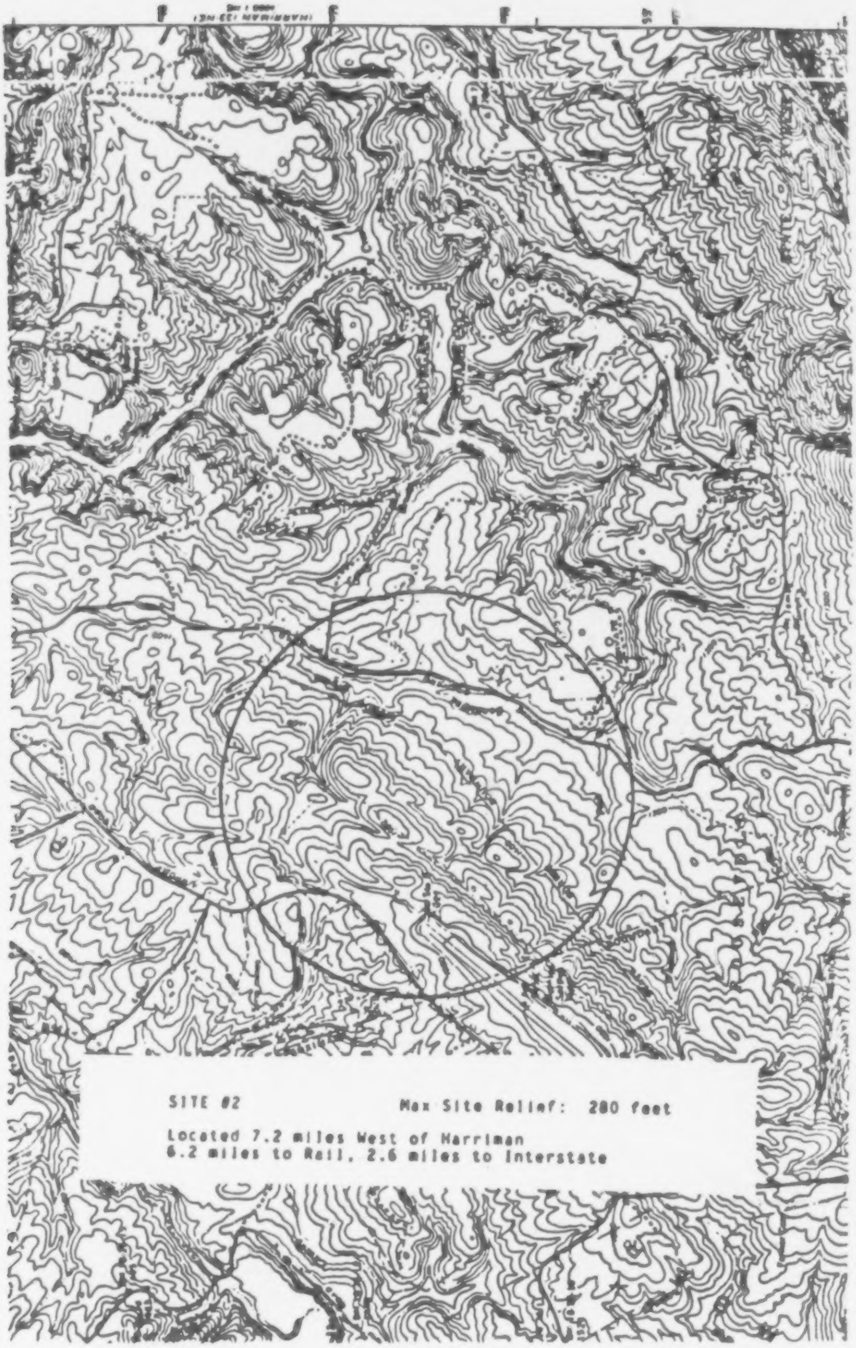
Located 12.4 miles NE of Crab Orchard
Remote Area. Difficult Access.



SITE #4 Max. Site Relief: 440 feet

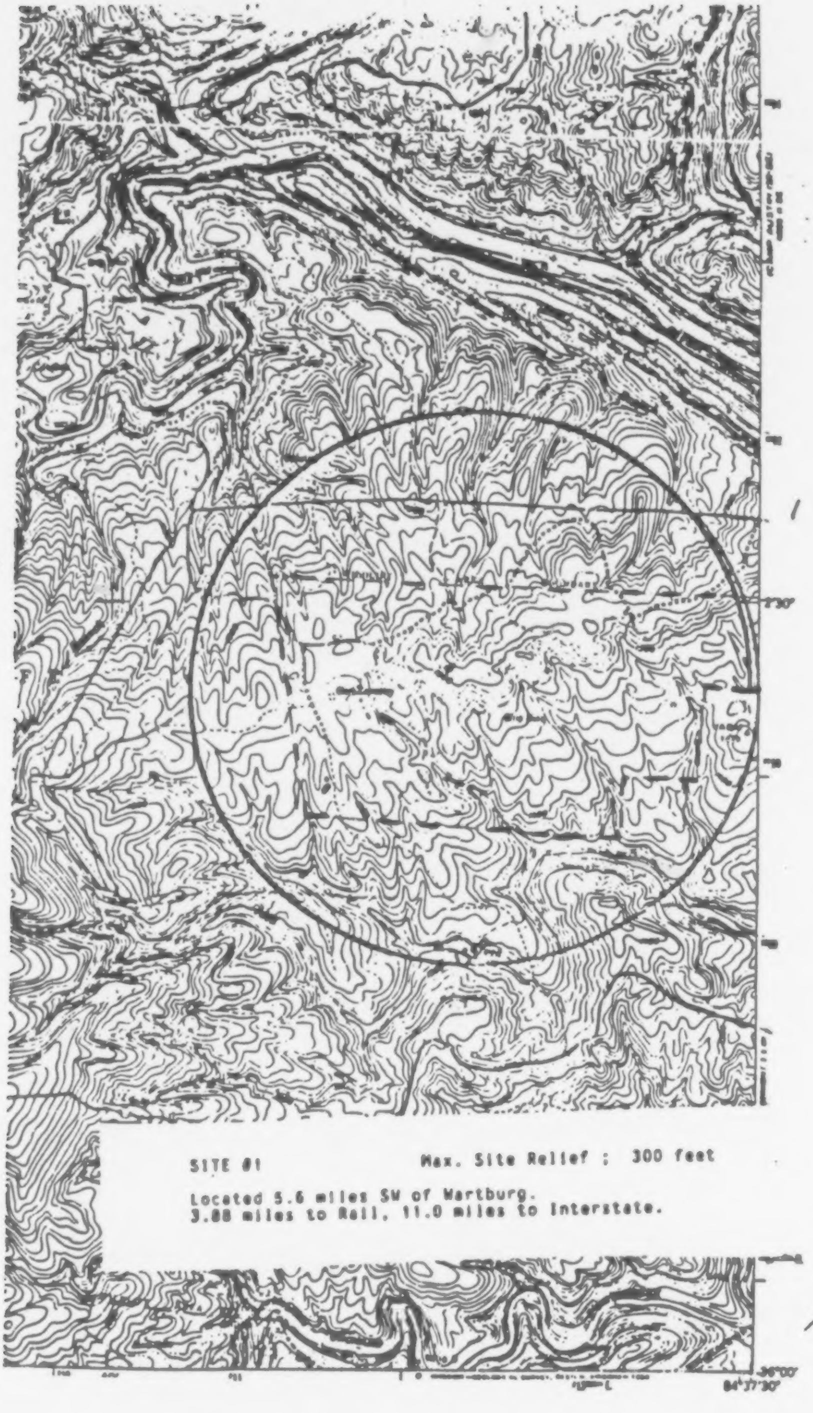
Located 4 miles south of Wartburg


SITE 03
Max. Site Relief: 320 Feet
Located 8.4 miles West of Harriman
7.4 miles to Rail; 5.2 miles to Interstate
ROANE CO
CUMBERLAND CO



SITE #2 Max Site Relief: 280 feet

Located 7.2 miles West of Harriman
6.2 miles to Rail, 2.6 miles to Interstate



SITE #1 Max. Site Relief : 300 feet

Located 5.6 miles SW of Wartburg.
3.88 miles to Rail, 11.0 miles to Interstate.

Testimony submitted to the
Senate Energy and Natural Resources Committee
Albert Gore Jr.
April 29, 1987

I would like to thank the Chairman for allowing me to submit testimony to the Committee on the important issue of our nuclear waste disposal program. This hearing focuses on the concept of a Monitored Retrievable Storage facility (MRS). Before we get too far in discussing the specific proposal brought to Congress by the Department of Energy, we must first consider whether we need a monitored retrievable storage system or could our goals be better met by other alternatives, such as on-site storage until a permanent repository is ready?

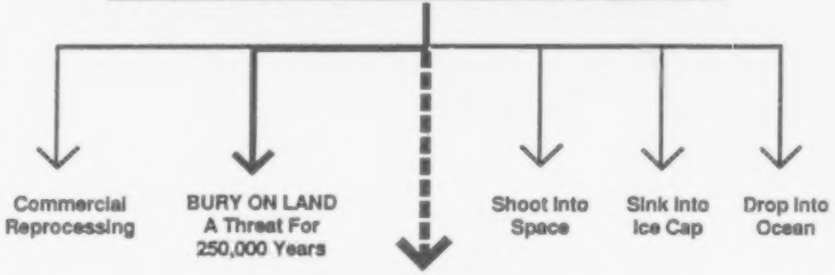
The Nuclear Waste Policy Act requires that "the Secretary shall complete a detailed study of the need for and feasibility of, and shall submit to the Congress a proposal for, the construction of . . . monitored retrievable storage facilities." The Congress is now embarking on this discussion of the MRS. The question of "need" is the one that must be most thoroughly explored before an MRS is authorized and funded. Not only is there doubt about the need for pre-packaging spent fuel, there is also doubt about whether a facility expressly dedicated to repackaging is either prudent or necessary.

We cannot accept a justification of the "need" of the MRS based on DOE's inability to meet the Act's deadlines for the completion of a permanent repository. This road leads to a defacto final repository in Oak Ridge, Tennessee. Tennesseans are not reassured by the Department of Energy's statements that the capacity of the MRS would be limited and that the MRS would not open until construction authorization of the permanent repository. In the past, DOE has seen fit to re-interpret the Nuclear Waste Policy Act.

I will do everything possible to stop DOE's efforts to turn the MRS into a quick fix political solution to the real problem of final nuclear waste storage. As Congress takes up the discussion of whether we need or want a monitored retrievable storage facility, I implore our colleagues to thoroughly scrutinize this misguided plan.

THE NUCLEAR WASTE POLICY ACT OF 1982
DISPOSAL OF HIGH-LEVEL WASTES (HLW)

HLW DISPOSAL ALTERNATIVES



Commercial Reprocessing

BURY ON LAND
A Threat For
250,000 Years

Shoot Into Space

Sink Into Ice Cap

Drop Into Ocean

THIS BROCHURE PRESENTS

A STRONG ARGUMENT THAT DOE HAS FAILED TO EVALUATE THE MOST VIABLE ALTERNATIVE

INTEGRATED WASTE MANAGEMENT, IWM

The IWM Disposal Plan Merits Investigation For it:

- **RESULTS IN A TEN FOLD REDUCTION IN HLW VOLUME**
- **REDUCES THE THREAT TO 10,000 YEARS** - a manageable period
- **REDUCES COSTS BY $30 BILLION** - while improving safety
- **PRECLUDES PLUTONIUM PROLIFERATION** -whereas DOE's plan will promote proliferation

The purpose of this brochure is to urge that

the 100th CONGRESS REQUIRE DOE

to carry out the Congressional mandates of Public Law 97-425, Section 222 of the NUCLEAR WASTE POLICY ACT of 1982 covering the investigation and evaluation of alternatives for the disposal of HLW. Twice data has been submitted to DOE in sufficient detail for an IWM evaluation. An intensive three hour search of DOE files on June 19, 1986 by the DOE librarian and the immediate staff of the OCRWM director uncovered neither (a) any IWM evaluation request information nor (b) any documentation related to DOE studies of other alternatives. Yet, since 1982, Congress has funded about $12 million annually to DOE for the study of alternatives as mandated under the Act.

NUCLEAR WASTE MANAGEMENT CREDENTIALS

of

Cleve Anderson

1065 East Flamingo Blvd.
Apartment 1001
Las Vegas, NV 89119
702-791-0590

1952-1953	Chairman, Hanford Ruthenium Emissions Task Force
1953-1958	Manager, Process Engineering Hanford Plant
1958-1960	Chairman, Hanford Waste Management Committee
1960-1969	Business Development Manager for General Electric's Commercial "Spent" Fuel Recovery Program
1969-1972	Manager, Corporate Marketing - Nuclear Atlantic Richfield Subsidiary
1973-1987	Consultant - Nuclear Wastes
	Expert Witness before Congressional Committee on Nuclear Waste
	Key witness on Nuclear Reprocessing in lawsuit Nebraska Public Power vs General Electric
	Consultant to the State of California Energy Commission Legal Counsel on Nuclear Legislation

3-1-87

ABSTRACT - WHY EVALUATE THE IWM PROCESS?

PLUTONIUM IS A VALUABLE ENERGY RESOURCE, NOT A WASTE.

FURTHER, IF LEFT IN THE SPENT FUEL, PLUTONIUM WITH ITS 24,300 YEAR HALF-LIFE MAKES PERMANENT REPOSITORY STORAGE UNTENABLE.

Optimizing HLW management by the IWM approach is not a new concept. IWM had its conceptual origin at Hanford in the 1950's where, even by then, it was clear that the HLW from reprocessing plants should not continue to be stored indefinitely in liquid form. The first progenitor of an IWM system was formalized for Hanford on December 15, 1958 in a document entitled Seven Year Waste Program, HW-58329. It was subsequently implemented by the French in modified form for their power reactor program.

Offsetting the risk and cost of interim liquid HLW storage in these modified IWM programs has been the demand for prompt plutonium recovery (about 120 days from reactor discharge). The heat liberation rate from radioactive decay precludes converting liquid high-level process wastes to inert solid-oxide form for at least five years

For energy poor countries like the French (and the British, Germans and Japanese), prompt recovery and recycle of plutonium is cost effective. They can rationalize the risk and added cost of holding the resultant HLW in liquid form for five years prior to converting the HLW to solid form.

The United States, on the other hand, has a unique opportunity to combine plutonium removal with concurrent HLW conversion to solid, inert-oxide form for permanent repository storage. Over 10,000 tons of spent power reactor fuel, aged the necessary five years, has already been accumulated in reactor storage basins. Thus, in the United States, the proposed IWM process can be optimized for HLW management with plutonium treated as the desir able and energy-rich byproduct that it is.

Standing in the way of the United States implementing rational policy for HLW management, however, is the apparent momentum of the DOE spent fuel burial program. Unless Congress demands that the mandates of the Nuclear Waste Policy Act, Section 222, be implemented, DOE will not evaluate the most viable alternative, IWM.

THIS BROCHURE PRESENTS IWM AND ITS SIGNIFICANT ADVANTAGES IN SUFFICIENT DETAIL FOR SUCH A SECTION 222 EVALUATION.

EXECUTIVE SUMMARY

The Nuclear Waste Policy Act of 1982, Public Law 97-425, was enacted to facilitate the permanent disposal of high-level radioactive waste, HLW. Congress assigned responsibility for implementation to the Department of Energy, DOE; they have selected ground burial of "spent" fuel as the preferred method. Section 222 of the Act, however, requires DOE to continue and accelerate a program of research, development, and investigation of alternative means and technologies for HLW disposal.

Under Section 222 funding, which must be approved annually by Congress, DOE has been spending about twelve million dollars each year. Their studies, though, have been limited to a) shooting the wastes into space, b) sinking the wastes into the polar ice cap, and c) dropping the wastes into ocean bottom silt. Based on DOE's written response, the suggested investigation of the Integrated Waste Management alternative, IWM, will not be performed without DOE being urged to do so by Congress.

A variant of the IWM alternative, called reprocessing, is used in the United States weapons program and overseas, in England and France. In a reprocessing plant, plutonium and uranium recovery occurs within 120 to 180 days of spent fuel discharge; the radiation levels are intense; costly, complex facilities are needed. The Purex plant at Hanford along with the British and French plants are operating examples. Commercial reprocessing activity in the United States has centered on the Nuclear Fuels Services plant at West Valley, New York, and the Barnwell plant in South Carolina. A serious drawback in these plants is that the resultant HLW disposal problem is made more difficult, to wit:

> The safety of HLW containment is compromised by the need to keep the HLW in liquid form for the five years required for radioactive decay prior to HLW solidification. This time period reduces the thermal heat output of the HLW to manageable levels.
>
> The volume of calcined HLW solids equals or exceeds the volume of the starting spent fuel assemblies.
>
> There is major degradation of the organic extractant due to the intense radiation levels; after three decades of operation, the British have yet to solve the waste disposal problem that results from the intensely radioactive organic "crud" that builds up in conventional reprocessing plants (1).

The IWM process, on the other hand, though employing similar chemistry, is optimized for HLW managment. To accomplish this, processing is delayed for five years following reactor discharge. Commercial interests (as well as Hanford, the British and the French) have demanded their plutonium as soon as possible and remain adamantly opposed to the five year delay required in the IWM waste optimized approach.

In the five-year time-delay period prior to processing, the net radioactivity level will have decreased one-thousand fold. This reduces processing requirements and costs to one-third that of a conventional reprocessing plant. Most important, the IWM plan allows solidification of the HLW process wastes to calcined, inert-oxide form concurrently with the recovery of plutonium and uranium. In the IWM facility, there would be no storage of HLW in liquid form.

Compared to the DOE spent fuel burial plan, the advantages of the IWM plan include:

> Reducing the HLW radioactive threat from 250,000 years, which is the case with the DOE plutonium burial plan, down to 10,000 years which, coincidentally, is the same as DOE's design life for the repository.
>
> Reducing the HLW disposal cost by thirty billion dollars by a) effecting a ten-fold reduction in HLW volume when compared to that of the starting spent fuel assemblies, b) reducing the enriching demands on DOE's facilities by the equivalent of eleven years at current production levels through use of fissile plutonium in lieu of enriched uranium, and c) reducing both HLW transportation costs and repository storage volume needs.
>
> Precluding future devious plutonium proliferation by destroying the plutonium as a fuel in the same power reactors from which it was discharged in spent fuel form. Contrary-wise, as will be demonstrated, DOE's present plutonium burial plan could facilitate plutonium proliferation.

This brochure is presented in sufficient detail to allow an objective investigation and evaluation of the IWM alternative as called for under Section 222 of Public Law 97-425, The Nuclear Waste Policy Act of 1982. Such an evaluation should be done before DOE's faulted "Burial" plan becomes immutable. Congress may have to provide firm encouragement and followup, however, to get this accomplished.

BACKGROUND

The disposal of "spent" fuels from nuclear power reactors has long been a contentious issue. Spent reactor fuels contain a complex array of radioactive products, the most important of which is plutonium. Beyond issues related to manufacture of weapons are those of public health. Plutonium accumulates in bone and one particle lodged in tissue can cause cancer.

The world's first plutonium production reactor was built at Hanford, Washington during World War II. Other large plutonium production reactors soon followed at both Hanford and Savannah river. Little useful energy was extracted from these government installations.

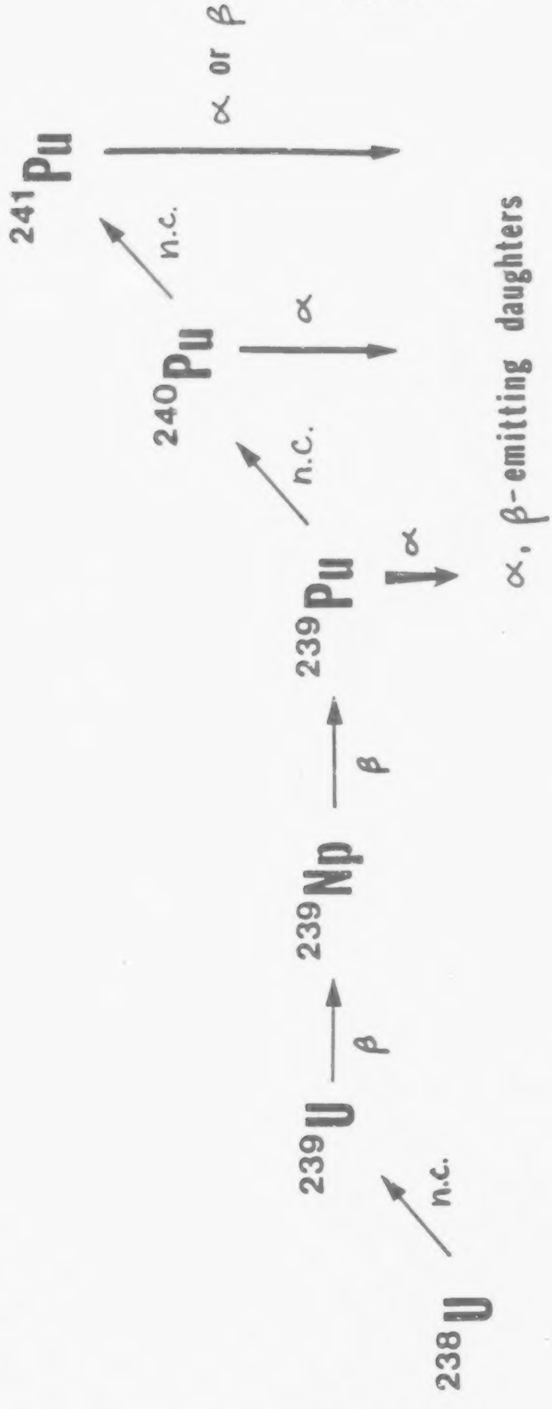
By contrast, energy is the primary product of the commercial reactor program; plutonium is a by-product. Although lagging twenty years behind, by the early seventies power reactor completions surpassed the government's both in number of operating reactors and in the quantity of plutonium being produced.

Figure I depicts how plutonium is formed in a nuclear reactor. Over 95 percent of the initial fuel consists of the non-fissile uranium-238 isotope. In the intense neutron field of a reactor, up to 1.5 percent of the uranium-238 is converted to uranium-239 by the capture of a neutron (labelled n.c.), with the final amount dependent on the duration of fuel exposure.

The uranium-239 emits a beta particle to form neptunium-239 which subsequently decays with a 2.3 day half-life to plutonium-239. This 2.3 day half-life for the decay of neptunium-239 is what determines the earliest practical time reprocessing plants start plutonium recovery as it takes about ninety days from spent fuel discharge for the decay of neptunium-239 to plutonium-239 to be completed.

Again refer to Figure I. Note that plutonium can also capture neutrons. Plutonium-239 can form non-fissile plutonium-240 which, in turn, can capture yet another neutron to form plutonium-241. Weapons people strive to maximize the plutonium-239 content in the recovered product. They do this by severly limiting the time the uranium fuel is left in the reactor.

FIGURE I


238U
n.c.
239U
β
239Np
β
239Pu
α
n.c.
240Pu
α
n.c.
241Pu
α or β
α, β-emitting daughters

Power reactors operators, on the other hand, want to maximize the reactor on-line availability, i.e. the time the reactor is operating and minimize the outage time for refueling. Thus, they use fuel exposure periods about one hundred times longer than do weapons people. For weapons plutonium, the exposure period is in the hundreds of megawatt days per ton. For power reactors, it is in the tens of thousands of megawatt days per ton of input fuel. The result is that in power reactors about twenty percent of the plutonium-239 is converted to the higher isotopes, 240 and 241.

Weapons can still be fabricated from the 80 percent plutonium-239 product. However, it is understood that such weapons are less efficient and less predictable. Rumor has it, though, that separation of plutonium isotopes by lazer techniques has been successful. If true, the lazer method would allow conversion of 80 percent power reactor plutonium into nearly 100 percent pure plutonium-239 for weapon purposes.

Being a fissile isotope comparable to the expensive uranium-235 isotope, plutonium can also serve as a reactor fuel. In fact, the origin of the plutonium production program was based in searching for a low-cost replacement for uranium-235 for bomb fabrication. Up until plutonium-239 became available in production quantities, uranium-235 was the sole source for weapons. Uranium-235 exists in natural uranium only to the extent of 0.71 percent. Separating it from the abundant non-fissile 238 isotope required massive gaseous defusion plants using inordinate quantities of electrical power. These plants were located in Tennessee and Ohio and some continue operating today, not for weapons but to supply relatively low enriched, but still costly, uranium-235 (about 3 percent) for power reactor fuel.

The anomaly is striking. In the 1940's, the government spent billions of dollars to build production reactors to obtain the lower-cost plutonium to replace the costly uranium-235 for weapons. Today, DOE plans to bury the essentially zero-cost power reactor plutonium in the ground in order to justify continued operation of their high-cost uranium enrichment plants.

Advocates of the DOE storage plan cite the primary justification as being one of limiting plutonium proliferation. As will be brought out in detail in the body of this report, the lowest cost and easiest way for a foreign group to obtain plutonium for weapons purposes is to accumulate it, in situ, in spent fuel form.

THE INTEGRATED WASTE MANAGEMENT PROCESS

Up to the mid-seventies, recovery and reuse of plutonium was viewed as an attractive power reactor fuel supplement. In this regard, plutonium has been serving as a reactor fuel since the inception of nuclear power. During the three to four year service life of the fuel a significant portion of the plutonium, which is being formed continuously within the fuel, fissions.

For the utility owners, plutonium fuel recycle placed a time-value on its early availability. They sought plutonium recovery from the spent fuel as soon as feasible, i.e. about 120 days following reactor discharge.

Commercial interests were eager to meet this need as it would become an annual repeat fuel service over the expected thirty year operating life of each reactor. It was likened to the razor blade business.

Two commercial ventures, Nuclear Fuels Services Company, NFS, in New York State and Allied-Gulf at Barnwell, South Carolina moved quickly to establish leadership positions with the utility customers. Both adapted the conventional Purex reprocessing technology from the weapons plant at Hanford. Both failed, however, primarily because they were not adequately prepared to handle the high-level radioactive residues from the plutonium recovery operation. The government's oscillating licensing policies further beclouded the issue.

By 1982, instead of being viewed as the valuable commodity source that they are, spent fuels had been labelled as strictly a waste disposal problem, that if unresolved, could result in the shutdown of all nuclear power stations. Storage basins at the reactor sites were nearing capacity. Congress was pressured to initiate prompt rescue efforts. As a result, the Nuclear Waste Policy Act was enacted and became Public Law 97-425 on January 7, 1983.

Under the Act, the government takes ownership of the spent fuels, with their contained plutonium, at the reactor sites. They are to provide timely removal of the spent fuels to either a) an interim monitored retrieveable storage facility, MRS, or b) directly to a permanent repository.

As indicated on the brochure cover, DOE plans to leave the plutonium, in situ, within the spent fuel. The half-life of plutonium is 24,300 years; DOE's design service life for the repository is 10,000 years. Even after 250,000 years, sufficient plutonium will remain to pose a threat to the food and water supplies of surrounding communities. Plutonium is a bone seeker; the lifetime body limit for plutonium is 0.6 microgram (2); by contrast, the weight of a single fingerprint is about ten micrograms. Assuming the spent fuel to be disposed of totals 100,000 tons, it will contain one thousand tons of plutonium.

Plutonium Recovery Alternatives

Figure II presents two markedly different approaches for resolving this plutonium threat to the environs. On the left is shown conventional reprocessing; it is used in France and England and was the design basis for the two U.S. commercial companies, NFS and Allied-Gulf. As Figure II shows, such reprocessing increases the problems of final HLW disposal. For example, the British have been in operation for over three decades and they still do not have an answer to safe disposal of the radiation-damaged organic waste (1).

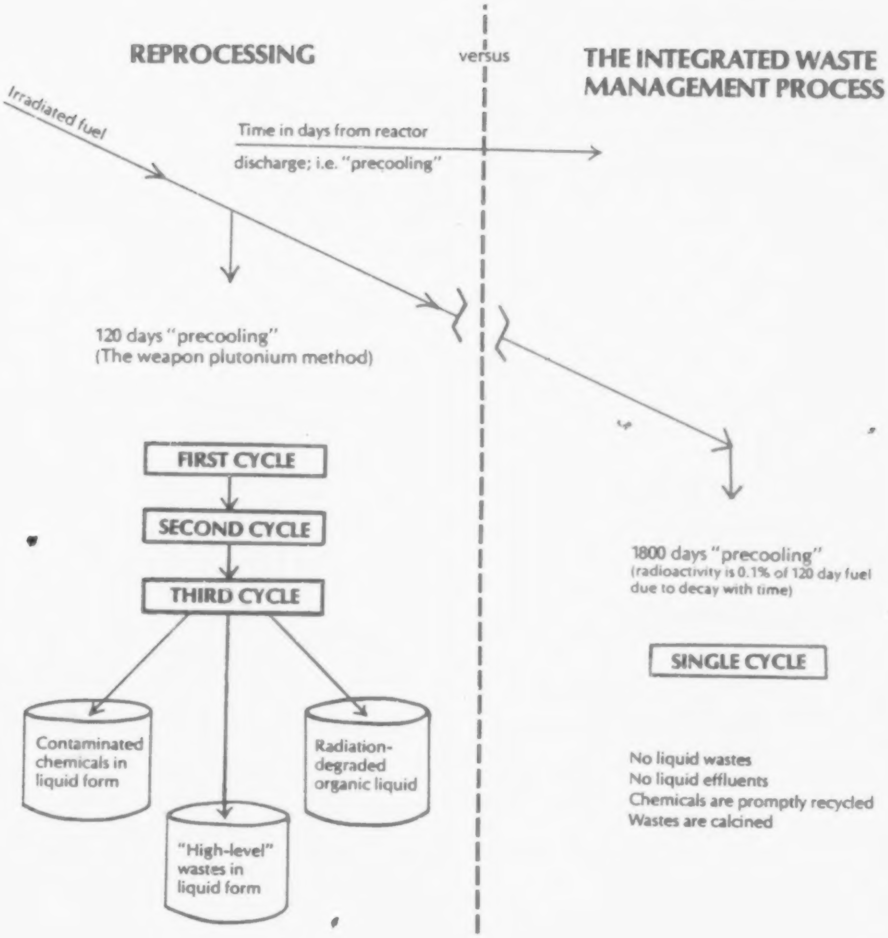
Before starting plutonium recovery from the spent fuel, these conventional reprocessing plants must still wait for at least ninety days for the 2.3 day half-life neptunium-239 to decay to the desired product, plutonium-239 (See Figure I). For scheduling purposes, 120 to 150 days of such spent fuel cooling is normally planned prior to the start of plutonium recovery.

However, the heat liberation rate is so high in the resultant liquid high-level wastes that conversion to solid form must be delayed for about five years. Storing these highly radioactive wastes in liquid form for five years introduces major risks. At Hanford, for example, the HLW has been stored in liquid form since startup of the first Hanford facility in the early 1940's. Tens of thousands of gallons of Hanford liquid HLW have subsequently leaked to the environs (3).

On the right side of Figure II, is shown the IWM alternative which is the prime subject of this report. By the 1970's, there was a school-of-thought in the nuclear industry that unless nuclear power arranged for and took care of the HLW it was generating, the future for the industry would be bleak. IWM was the answer they came up with.

In the early to mid 1970's, though, utility executives would not consider IWM; to wait the five years required by IWM to get back their plutonium fuel was untenable. The passage of time has changed that picture. Today, however, the nuclear utility executives are still not interested in IWM but for

FIGURE II


REPROCESSING
versus
THE INTEGRATED WASTE MANAGEMENT PROCESS
Irradiated fuel
Time in days from reactor discharge; i.e. "precooling"
120 days "precooling" (The weapon plutonium method)
FIRST CYCLE
SECOND CYCLE
THIRD CYCLE
Contaminated chemicals in liquid form
"High-level" wastes in liquid form
Radiation-degraded organic liquid
1800 days "precooling"
(radioactivity is 0.1% of 120 day fuel due to decay with time)
SINGLE CYCLE
No liquid wastes
No liquid effluents
Chemicals are promptly recycled
Wastes are calcined

two markedly different reasons: 1) they have a glut of uranium fuel commitments made during the optimistic period of nuclear power, and 2) the DOE has bailed them out of any obligation for final disposal of the HLW. Utilities have no other responsibility for the disposal of HLW (in spent fuel form) than to pass through to their customers an assessment fee per KWH of electricity delivered to cover same.

DOE appears to be trying to balance several factors. Two of them are the domestic uranium industry which DOE tries to encourage (4), and DOE's own uranium enrichment operation which DOE is trying to keep viable. For example, in the 100,000 tons of spent fuels, (or more), that DOE is scheduling for burial the quantities of contained uranium and fissile plutonium are equivalent to twenty years of domestic uranium mining output based on 1983 production figures, and eleven years of uranium-235 enrichment services at current demand levels. Such DOE actions give the appearance that DOE would bury useful nuclear fuels into the ground in order to justify digging uranium out of the ground and, of course, subsequently enriching it in uranium-235 content.

The alternative, IWM, can be implemented today with no penalty assessment for time-delay in recovering the plutonium as thousands of tons of spent fuel, aged five years or more, are awaiting DOE disposal. The safety and economic advantages of IWM when compared with either a) conventional reprocessing, or b) DOE's spent fuel burial plan include:

1) Resolving the liquid HLW problem by converting them into solid, inert-oxide form concurrently with the recovery of plutonium.

2) Eliminating the organic degradation problem (which plague conventional reprocessing plants) by reducing the radioactive intensity by a factor of one thousand.

3) Eliminating the need for used chemical disposal by recycling essentially one-hundred percent of the principal chemical, nitric acid.

4) Fabricating the recovered plutonium into finished mixed-oxide fuel assemblies on-site in a contiguous facility; there would be no storage of plutonium except in finished fuel form ready for insertion back into the power reactors from which it was discharged. Shipment back to the reactor would be in the same tamper proof shipping cask used for

transporting the spent fuel to the IWM facility.

5) Reducing final HLW volume to about ten percent that of the spent fuel assembly; i.e. the repository volume needs for IWM would be one-tenth that of the DOE spent fuel storage approach.

IWM Compared to Conventional Reprocessing

In the recovery of plutonium after only 120 days as is done in conventional reprocessing plants, a separation factor of one hundred million to one is required. The Hanford Purex plant, as well as its counterparts in England and France, routinely perform this outstanding technical feat. It is believed to be a magnitude better than that achieved in the purification of the silicon used in manufacturing semiconductor wafer chips.

With radiation energy, though, time can serve as an ally. This factor of radioactive decay with time is the key to the IWM process. By design, in an IWM facility the spent fuel must be cooled for five years prior to the start of processing. As a result, the IWM process need purify the plutonium by a factor of only one hundred thousand to one or but one-tenth of one percent that required by conventional reprocessing plants.

A ready reference for a conventional reprocessing plant is available in the NRC document room at 1717 H street, N.W., Washington, D.C. It was filed by Allied-Gulf for their Barnwell plant and consists of their licensing application along with related correspondence. The following breakdown will be used to compare this Barnwell facility to the proposed IWM process:

Construction Costs
Fuel Receiving
Fuel Assay
Plutonium Recovery
Organic "Disposal"
Chemical Needs
Interim Storage of HLW

Construction Costs

The Barnwell plant was built in the mid-seventies. The HLW was to be held in liquid form in stainless-steel tanks for a five year period period prior to conversion to solid inert-oxide form by a calcining process. Allied-Gulf asked the DOE to fund the HLW calcining step but DOE declined. Also, there was great uncertainty on the part of Allied-Gulf as to just what the government's waste disposal policy was. An impasse developed and Barnwell was never licensed as an operating facility.

Despite this unresolved HLW problem at Barnwell, the spent fuel processing and plutonium recovery portion of the plant is typical of conventional reprocessing. Allied-Gulf, in fact, advertised the Barnwell technology as patterned closely after the 1955 Purex plant at Hanford and therefore well proven by two decades of operation. It could handle spent fuel cooled only 120 days from reactor discharge; the IWM, on the other hand, must let the fuel cool for five years.

The plants do have in common that each would be remotely operated and maintained and personnel would be shielded by five feet of concrete or equivalent radiation shielding. In such remotely operated plants, construction costs have been found to vary linearly with the number of processing steps as each process vessel requires its own connectors to and from the process equipment as well as its own remotely operable cell space.

Such cost relationships will be illustrated for each process facet of a conventional reprocessing plant (Barnwell) versus the far fewer number for the proposed IWM facility. First, though, as a guide to the subsequent discussion, is the final answer; an IWM facility would need forty individual processing steps; Barnwell needs one hundred forty. That is IWM requires only thirty percent the number of processing steps of a conventional reprocessing plant. Recognizing the need for common facilities such as site, office space, etc. the IWM costs have been estimated to be about forty percent that of the same capacity Barnwell-type reprocessing plant.

Assuming Barnwell were completed by adding the required waste conversion equipment, the construction cost would total about $1,400,000,000 These costs are detailed in correspondence between Allied-Gulf and DOE and are on file in the NRC document room in WDC.

The IWM facility would then cost out at $560,000,000. For purposes of comparing the IWM approach to the current spent fuel burial plan of DOE in 1987 dollars, the cost of a ten ton per day, 3000 m. ton per year IWM facility has been taken as one billion dollars.

Fuel Receiving

Without modification, the existing fuel receiving basin at Barnwell can hold 400 tons of spent fuel. Using high-density canisters and racks, as is the practice today at reactor sites, Barnwell could hold up to 1800 tons.

By contrast, the IWM facility would need a fuel receiving basin only ten percent the size of Barnwell's. This would give it 180 ton of spent fuel storage and only a fraction of this storage capability would normally be required. Capitalizing on the "on-time" delivery concept for their suppliers which has been implemented so successfully by the Japanese auto industry, shipments of spent fuel would be scheduled into the IWM facility in accord with plant processing needs.

Barnwell, on the other hand, was designed to isolate every batch of customer spent fuel. Processing of any given customer's fuel could not start until the entire discharge batch had been received at Barnwell. With tens of customers, and months required to complete delivery for each reactor discharge batch, the Barnwell storage basin became a holding station requiring large capacity.

For the IWM facility, there would be only one customer since, by Public Law 97-425, DOE takes ownership of the spent fuel at the reactor site. With a 180 ton holding capacity, the IWM could hold fuel from thirty-six cask shipments (assuming 5 tons of spent fuel per shipping cask). At the proposed ten ton per day processing rate this would amount to eighteen days of lag storage for the IWM receiving basin.

Fuel Assay

In the Barnwell-type contracts, each utility retained ownership of its spent fuel and the contained plutonium. They insisted on accurate assay control of the plutonium delivered to and received from the recovery plant. Written into each customer contract were stringent segregation requirements of the fuel in the receiving basin and subsequently within the processing plant and at the product delivery dock. As mentioned previously, plants such as Barnwell had to provide capability to receive and segregate not only each customer's fuel in the receiving basin but to do this, batch-by-batch, for each reactor discharge. In addition, following dissolution of the spent fuel, sophisticated and costly assay tanks, sampling techniques and laboratory measurement procedures had to be in place to accurately determine the plutonium content of each batch. The same precise and difficult assay techniques were required on the recovered plutonium to assure each customer that he would be receiving back the same plutonium he had delivered.

For the IWM facility, ownership by one party of the spent fuel (in this case the DOE) and its contained plutonium simplifies assay requirements. Assay capabilities needed for process control must be retained but these represent only a small fraction of the facilities that had to be installed at Barnwell to satisfy customer demands for individual identification and isolation of each batch of their fuel and recovered product.

Plutonium Recovery

The Barnwell-type plant processing 120 day cooled fuel and an IWM facility designed to handle only five-year cooled fuel, use common chemistry. Both dissolve the fuel in nitric acid. Both employ solvent extraction to separate the plutonium from the HLW. However, it is here in the solvent extraction portion of the plants that another major difference exists. A Barnwell-type plant requires three cycles of solvent extraction whereas the IWM plant requires only one.

One cycle of solvent extraction involves first transferring the desired product from the aqueous nitric acid phase to an organic extractant (tri-butyl phosphate in kerosene) wherein the fission product wastes remain in the aqueous phase. This is followed by a very low acidity wash of the organic phase to effect transfer of the product back into a dilute nitric acid solution.

To process 120 cooled feed, the Barnwell plant requires three such solvent extraction cycles to obtain the final product purity. In addition, between each cycle large steam heated evaporators are needed to concentrate the dilute aqueous stream from the previous cycle before introducing it as feed to the next cycle.

The IWM plant, on the other hand, requires only one such solvent extraction cycle. By waiting five years for the radioactive decay in the spent fuel prior to plutonium recovery, the separation factor required between the plutonium and the HLW is only one one-thousandth that of the 120 day cooled material. Further, after the first three years of cooling, the most difficult fission products to separate from the plutonium, zirconium-niobium (5), are essentially fully decayed. This allows optimization of the process for plutonium separation and recovery; it is expected that greater than 99.9 percent of the plutonium can be routinely separated from the HLW under IWM process conditions.

Organic Disposal

When processing fuel in a Barnwell-type facility after only 120 days cooling, the radiation level is so intense that two completely separate organic systems are required. For the first cycle of such a high-radiation plant, the resultant radiation damage is severe; constant chemical treatments are attempted in order to remove the polymerized tacky organic wastes. The second organic system in a Barnwell-type plant parallels that of an IWM process as to radiation induced problems for the radiation level is comparable to the IWM single organic system. There is a significant exception, though, as the radiation damaged organic from the first cycle in a Barnwell-type plant tends to carry over to subsequent cycles.

In sharp contrast to the first cycle of the Barnwell-type plant, the IWM single organic system would have to be in operation for twenty years to equal the radiation exposure occuring within a single week in the first cycle of a plant handling 120 day cooled fuel. As mentioned earlier, the British seem to still be in serious trouble with trying to treat and dispose of their radiation-damaged organic. At their Sellafield reprocessing plant, for example, Greenpeace discovered gross quantities of highly radioactive organic goo on the ocean surface near the British plant's outfall (1).

Chemical Needs

Nitric acid is the main chemical used in a plutonium recovery plant. The spent fuel is dissolved in nitric acid. A high nitric acid content in the feed to a solvent extraction battery serves as the salting agent to drive the plutonium from the aqueous phase into the organic phase. Subsequently, a low concentration of nitric acid is used to scrub the plutonium from the organic phase back to an aqueous one. Both the recovered plutonium product and the solvent extraction HLW exist in nitrate form in nitric acid solutions.

For the Barnwell-type operation, as well as in France, the liquid HLW is stored for five years, prior to converting the HLW to solid form, to allow for the decay of the shorter-life radioactive isotopes with their resultant high heat liberation rates. The nitrate ion and the nitric acid are driven off in the subsequent HLW calcining step and recovered as a nitric acid solution for reuse back in the plant's dissolver. However, fresh nitric acid supplies are required daily for the first five years of operation of such plants.

In the IWM approach, the five-year cooling required prior to calcining the wastes takes place before the fuel is even shipped from the reactor to the IWM plant. The result is that the process wastes, HLW, would be calcined concurrently with the recovery of plutonium. This recovered nitric acid from the calcining operation would be continously fed back to the dissolver thereby producing a closed cycle on nitric acid needs. The first tank car of nitric acid delivered to an IWM facility should suffice for several years of operation.

Interim Storage of High-Level Wastes

For the Barnwell-type process operating on 120-day cooled fuel, stainless-steel tanks are required to store the process HLW in highly mobile liquid form for five years prior to conversion to solids. The number and size of these HLW holding tanks would be a function of throughput and the gallons of liquid HLW produced per ton of fuel processed. At a three thousand ton per year throughput, a five-year holding period, and one hundred gallons of liquid HLW per ton of fuel processed, one and one-half million gallons of interim storage would be required. During those five years, continuous cooling of the liquid HLW is mandatory.

In sharp contrast to the interim HLW tank storage needs of the Barnwell-type process, the IWM needs none. Having by design waited five years prior to the start of processing, the IWM HLW can and would be converted to solid inert-oxide form and encased in heavy gauge stainless-steel canisters concurrently with the plutonium recovery step.

THE $30 BILLION DIFFERENTIAL

BASIS:

100,000 metric tons of spent fuel
33,333 m.t. mixed-oxide reload fuel
Dollars in millions

DOE's Spent Fuel Burial Plan		The Integrated Waste Management Plan - IWM
$3,000	Shipping - Monitored Retrievable Storage to Repository	$1,000
13,000	Repository cost	3,000
8,840	Uranium yellowcake	zero
1,635	Conversion to UF6	zero
17,950	Separative work - 3%	zero
zero	Purify plutonium	
	capital	1,000
	contingency	500
	operating/maintenance	1,000
1,332	Conversion to pellets*	6,666
5,320	Fabication $160/kg.	5,320
$51,077	TOTAL	$18,486

The DOE Burial Plan is estimated to cost $32,591 million more than the Integrated Waste Management Plan. This savings in cost for IWM has been rounded to $30 Billion.

*$40/kg for UO2
$200/kg for PuO2/UO2

PLUTONIUM PROLIFERATION

Storing spent fuel for five years, or more, prior to plutonium recovery can have either of two diametric results; one is bad, the other good.

For any nation or group intent on accumulating plutonium for weapon purposes, the lowest cost and easiest method is to store it, in situ, in spent fuel form prior to weapon fabrication need. Time of storage is their ally. After five years of radioactive decay of the contaminants, plutonium recovery can be by a simple, commercially available process. Although not responsive to safe HLW disposal, such a plutonium recovery plant might consist of only a dissolver for putting the spent fuel into solution and an anionic process for snatching out the plutonium. The residual liquid HLW could be discharged into interim underground holding tanks, as Hanford has done, or dumped directly to ground.

Advocates of the DOE burial plan claim that it precludes plutonium proliferation. In reality, should the United States be successful in having third world countries adopt a similar storage approach, it would be an invitation for plutonium accumulation, world-wide.

The only way to stop plutonium proliferation is to destroy the plutonium by the only known peaceful means; recycling it as fuel back into the same reactors from which it was discharged. The Integrated Waste Management process accomplishes this for US reactors. With this IWM example for the world, the US could become the leader for putting an end to plutonium proliferation. This fuel recycle approach, obviously, has an extension to the destruction of weapons plutonium as well as power reactor plutonium.

With IWM, the recovered plutonium would be fabricated into mixed-oxide fuel in a facility contiguous with the IWM plant. All fabrication waste would be sent back to the IWM dissolving system, thereby eliminating a major cost factor for plutonium fuel manufacture. The final mixed-oxide fuel assembly would be completed on site for return to the power reactors in the same high-integrity shipping casks used to transport the spent fuel.

REFERENCES

1) HARPER'S, February 1985, p. 65, Bad News From Britain, by Marilynne Robinson.

2) Handbook of Chemistry and Physics, 1977-'78 Edition.

3) ERDA 1538, Final Environmental Statement, Waste Management Operations, Hanford Reservation, Dec. 1975, Vol 2, p II, I-C-83.

4) DOE 0477, Domestic Uranium Mining and Milling Industry, October 1985.

5) Reactor Handbook, Vol II, Fuel Reprocessing, Interscience Publishers Inc., NYC, 1961, p 121.

Presented to members of the following Congressional Committees and Subcommittees of the 100th Congress - April 1987. For the Committees noted with an asterisk, distribution was limited to the chairman's office only. For all other Committees and Subcommittees, a copy was made available to each member.

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